PART ONE: EXECUTIVE SUMMARY
"High Technology Business Accelerator for Russia"

Introduction

This report addresses two related issues regarding enhancement of the employment opportunities for Russian scientists who formerly worked on programs to develop weapons of mass destruction (WMD) at the closed nuclear cities and chemical and biological institutes. In March 2001, the Sam Nunn School at Georgia Tech hosted a group of 44 Russian scientists, Ministry officials, NGO researchers, and Duma legislators at a week-long seminar that included former Senator Sam Nunn's annual Policy Forum. The subject of the Policy Forum was "Russian Scientific Talents: Economic Opportunities and Challenges."

During the week-long program, the Russians spent an afternoon at Georgia Tech's Advanced Technology Development Center (ATDC), a highly successful high-technology business accelerator (generically called an "incubator"). The ATDC has been in operation since 1981. It has compiled a very successful record of helping entrepreneurs develop advanced science and technology discoveries at Georgia Tech and elsewhere into successful commercial businesses. Our Russian visitors were sufficiently impressed that they asked Senator Nunn if the Nuclear Threat Initiative (NTI) could open a high-technology business accelerator in Russia, to help their scientists to develop commercial businesses.

The authors of this report have been given two tasks by NTI. Our primary task is to determine whether one or more high-technology business accelerators modeled on the ATDC could enhance commercial opportunities and provide employment opportunities for Russian scientists at the closed cities and chemical and biological (hereafter, chem-bio) institutes. If so, we are to identify where and how they should be established and function, what changes would be required to meet particular Russian conditions and constraints, and what such a program would cost. The second task we were given is that, if we conclude that high-technology business accelerators in Russia are unlikely to achieve NTI's objectives, to identify other approaches to enhancing Russian scientific employment that NTI should consider. Since we are recommending a business accelerator approach, the second issue is moot.

Key Assumptions for This Study

We have made the following key assumptions in this study. First, as a new entity, NTI will want its first projects in Russia to be successful, given the mixed record of many prior and ongoing US-sponsored activities. Although our recommendations cannot guarantee success if implemented, we have elected to increase the likelihood of success by recommending a "robust" rather than "skeleton" funding profile for the proposed demonstration program. Second, we assume that NTI's effort cannot afford to be seen by the Russians as yet another "US plan." Rather, it must involve and be led by Russian institutions and Russian participants from the beginning, and must become a Russian venture supported by limited (and diminishing) US and western advice and assistance. Thus, one focus of our study is on identifying appropriate Russian institutions and

organizations with which NTI could successfully partner. Third, we assume NTI would want our recommendations, if they were successfully implemented, to provide an outcome capable of replication at other WMD facilities in Russia without requiring further major investments by NTI. Finally, we assume NTI is seeking opportunities to partner with existing efforts by others, where possible. Therefore we have identified a number of Russian and western organizations which NTI might wish to approach with proposals for joint funding to better achieve both their and NTI's objectives.

What is a "High Technology Business Accelerator?"

Georgia Tech's ATDC takes into its facility small high-technology startup businesses, and surrounds them with a range of services and supporting activities designed to help them to grow within the facility to become rapidly-growing enterprises, capable of prospering in the outside civilian economy. ATDC has developed criteria for both the admission of new startups, and for dismissing startups that, once admitted, fail to prosper and graduate into the civilian economy within a reasonable time (nominally three years). ATDC measures its success in terms of the number of high-tech companies that move from ATDC into the economy and continue to prosper, adding revenue and employees (within the State of Georgia.)

ATDC and Georgia Tech provide lower-cost office and production facilities, available service providers for secretarial support, and basic accounting, payroll, and communications services, which are common to most western incubators. In addition, ATDC and Georgia Tech provide assistance with: contracting and other legal issues; raising additional capital investment; marketing; technology networking; project management and business planning mentoring; and development of a range of other necessary entrepreneurial skills. If the ATDC has a "secret of success," it probably is to be found in the extent of its entrepreneurial and business mentoring provided to the startups. Many of the scientists seeking to commercialize their technology discoveries through the ATDC have had little or no business training. The ATDC currently has seven full-time "entrepreneurial catalysts" (mentors) who provide one-on-one business management training (in project management, setting deadlines, operating within a budget, financing and marketing assistance, etc.) to most of the 39 startups currently in the ATDC. They provide ongoing advice on business plan development and strategic planning. Of great importance is their direct consulting to the startup's management on effective interaction with venture capitalists. Each of these mentors is a successful entrepreneur who has experience in technology commercialization and/or has managed one or more startup businesses or technology ventures. These mentors still have an entrepreneurial zest for turning startups into profitable businesses, but have decided to provide counsel to startup enterprises for a period of their careers. Many of these mentors will return to management of a startup, sometimes one already at ATDC. While effective, such mentors are also expensive; more than 65% of the ATDC's budget for salaries is paid to the mentoring staff.

This constitutes the basic model we would propose to apply to a business accelerator intended to commercialize high-tech concepts held by Russian scientists at the closed cities and chemical and biological institutes. This model, however, must be examined for

basic feasibility and for necessary modifications to meet Russian business and entrepreneurial conditions. Further, it should be understood that no business accelerator can provide thousands of new jobs in a short period. Most of ATDC's graduate firms have fewer than 100 employees when they graduate, and only a few will grow thereafter to employ as many as a thousand employees. However, since many of the types of jobs created are high-tech, the economic impact can be significant.

Russian Incubator Experience

Many Russian incubators already exist, in cities large and small, under a variety of names (incubator, technopark, innovative business center). Many (perhaps most) are focused on lower-tech startups. These are helping to develop bakeries, restaurants, accounting firms, and small manufacturing businesses; all are making a modest contribution to employment in Russian small businesses, which are significantly fewer per capita in Russia than in most developed countries.

Some of these Russian incubators are located at or near some closed cities and chem-bio institutes, and some are affiliated with Russian universities and/or government Ministries. Since several of the Russian visitors requesting "a Russian ATDC" are well aware of these existing incubators, our initial presumption was that their record in producing numerous high-tech commercial enterprises must be somewhat wanting. Our site visits have generally confirmed this. We have seen that many Russian high-tech incubators operate under a set of peculiarly-Russian constraints that, taken together, create negative incentives -- for both the incubator operators and the startup firms in the incubators -- to graduation from the incubator and growth as Russian high-tech commercial enterprises.

Most small high-tech startup companies currently in Russian incubators we visited are reluctant to become so large that they would need to move out into the Russian civilian economy. Why is this?

First, the incubator provides the startup with cheap rent, some secretarial and business support, good utilities, excellent security, the prestige (and potential protection) of association with a major technological university and/or Ministry, and protection from criminal extortion. If the startup were asked to leave the incubator, its owners would immediately be faced with much higher costs for all of the above services, jeopardizing the current profitability and inhibiting growth. Since venture capital for the expansion of small Russian startups appears to be nearly nonexistent outside of Moscow and St. Petersburg, in many cases the entrepreneur cannot afford to leave. Instead, firms open small production facilities outside the technopark, but keep headquarters and R&D facilities in the technopark.

Second, most of the heads of the small high-tech startup companies we visited showed no real interest in growing rapidly; most are serving only a small domestic market niche. This is often referred to as a "lifestyle" business, providing its owners and workers with a comfortable and reliable living standard. "We want to remain below the threshold of visibility" was a recurring theme. This refers to the problem of coping with the tax authorities, given Russia's conflicting tax laws and regulations, which give enormous

latitude to the tax assessors; marginal tax rates can even exceed 100%. It is widely recognized in Russia that small businesses must keep two sets of books. Indeed, Russia formerly imposed income taxes on business losses, ostensibly to assure collection of revenue from even those whose "white" accounts show a loss ("otherwise no one would show a profit"). While being in an incubator does not eliminate the obligation to pay taxes, it apparently reduces the likelihood of audit or harassment by the tax authorities.

Third, Russian high-tech incubators have little incentive to promote rapid growth and subsequent departure of their tenants. The revenue from the rent paid by their more mature startups is an important funding source to the operators (unlike ATDC, which receives State of Georgia funding.) Departure of tenants into the civilian economy would leave incubator space to be filled by an immature startup, and incubator operators appear to lack confidence in an adequate flow of new, financially-sound entrants. They would rather face the problem of finding more incubator space to accommodate expanding businesses.

The implications of these constraints for the development of Russian high-tech enterprises are clear. Where ATDC looks for graduation (or dismissal) of an average of 13 firms a year, and intake of an equal number of new startups, there is little turnover at Russian incubators. Over time, ATDC's approach will put many more small high-tech firms into the civilian economy, and bring in many more new starts, than a similarly-sized Russian technopark. Thus, one major challenge for NTI is to alter the incentive structure at Russian high-tech incubators -- for both their startups and the incubator operators -- in order to dramatically increase the numbers of commercial firms moving into the Russian economy.

Challenges for "Business Acceleration" at Closed Cities and Chemical and Biological Institutes

One constant question we posed at each of our meetings was for the Russian participants to identify the most important limiting factors they see to the growth of high-tech enterprises in Russia. The three most prevalent, almost universally cited, answers were:

- shortage of startup capital for new enterprises
- lack of sound project management skills and advice, and
- lack of access to, or understanding of the needs of, western markets.

All three of these limiting factors apply with special force to high-tech enterprises at closed cities and remote chem-bio institutes. All must be addressed to create a successful program. The geographic isolation of the former WMD sites introduces several further problems.

First, most venture capital for startups is available only in Moscow or St. Petersburg. This VC money tends to be committed only to established companies with positive cash flows. Such resources are severely limited elsewhere, and there is virtually no "Angel" funding.

Second, under the Soviet Union, these former WMD facilities were all "favored" institutions whose products were not cost-constrained, and whose budgets were lavish. No one had to manage to a western style budget. The nuclear centers are having greater difficulty making the transition to operating in a market economy and developing new commercial opportunities than the chemical and biological centers.

Third, almost all of these institutions are trying to market "technology push" proposals, whereas western markets operate primarily on the basis of meeting someone's needs ("demand pull.") The top scientists of these institutions for the most part have only a limited understanding of the products that markets (particularly high-tech markets) are seeking, nor do they understand how to go about trying to determine market needs. A critical missing ingredient in promoting new high-tech businesses at the closed cities and chem-bio institutes is better Russian and western guidance as to identification of technologies that may have either strong Russian or western market potential. There is a limited Russian domestic market for high-tech products.

Fourth, logistics, infrastructure and communications at virtually all the remote sites are all inferior to those in Moscow and St. Petersburg. At many of the sites, former WMD production facilities may be unsuited to be used for commercial production without costly modernization and cleanup. All of these considerations reduce the likelihood that a small but successful startup firm at a closed city or remote site will elect to set up a large production facility where it has been incubated, even for the domestic market. Nor are outside companies that might purchase a new high-tech startup likely to invest in production there. Thus, high-tech "commercializing" by top scientists may <u>not</u> employ many of their non-scientist colleagues at these former WMD sites.

Fifth, "trust" among strangers in Russia must be earned; it does not come automatically. Even Russian entrepreneurs hired as mentors to a business accelerator at the closed cities or chem-bio institutes will have to spend time in those locations earning confidence and trust. This process will be harder still for western advisors.

Sixth, finding entrepreneur-mentors, western or Russian, willing to spend considerable time at either closed cities or remote chem-bio institutes will be both challenging and expensive. We believe it will be necessary to rely primarily on young Russian entrepreneurs as mentors at the field sites, aided by occasional visits from senior western mentors, based in Moscow. It will be necessary to arrange a variety of training links between senior mentors in Moscow and elsewhere, and the Russian entrepreneur-mentors at the remote sites. Use of Russian entrepreneur-mentors will also reduce the language difficulties in day-to-day mentoring at the remote sites, and will, over time, build a cadre of Russian "senior mentors."

Seventh, it is our judgment that commercialization prospects from science available at the closed nuclear cities are significantly different than those at the chemical and biological institutes. Therefore, different teams of entrepreneur-mentors may have to be established for each type of institution.

Differentiating Between the Closed Cities and the Chemical and Biological Institutes

The closed cities are all under the administration of the Ministry for Atomic Energy of the Russian Federation, or "Minatom," while the various chemical and biological institutes respond to a variety of other ministries and agencies. Thus Minatom approvals can enhance cooperation in endeavors; but Minatom can also slow this process. The closed cities require a series of high-level government approvals before outsiders, especially non-Russian citizens, may visit. Western venture capitalists and businessmen are unlikely to tolerate 60-day waiting periods for visit approvals to closed cities. American mentors to small Russian startups in the closed cities will find it difficult to perform the kind of one-on-one mentoring that ATDC would consider critical to ensure growth, unless simplified Minatom access can be negotiated. Access to some, but not all, chem-bio facilities is similarly restricted in principle, but access to the cities in which they are located and the technoparks outside the fences of these closed sites is not restricted.

Second, western interest in the technologies these Russian institutions might have to offer varies considerably. Most US firms lack information about Russian technologies derived from WMD research, and show little interest in learning more about commercial possibilities. Mention "Russian" and "nuclear" in the same sentence and most US businessmen and venture capitalists lose interest. Other western companies are more interested in some aspects of Russian technology from the nuclear institutes, but primarily for large-scale projects in the west. Several of our interviewees questioned the extent of commercializable technologies suitable for small startup companies that might become available from the scientists at the closed cities. Similarly, major western pharmaceutical companies have been slow to show interest in Russia, but smaller firms are looking selectively. A few western chemical companies are also taking a look. But, much marketing will need to be done.

Third, most of the searching for Russian technologies that might meet western needs is being performed by small "technology mining" firms, most of which are run by western expatriates. Their aim, for the most part, is not to create small and medium enterprises, but rather to capture Intellectual Property rights for marketing in the west. While this can often enrich a few principal scientists and/or their institute, it provides no continuing employment effect.

Finally, several western institutions are pursuing goals at either chem-bio institutes or nuclear cities that appear to be complementary to those of NTI. It may be possible for modest NTI assistance and funding to help to make their existing projects lead to more effective employment results.

A High Tech Business Accelerator Option for NTI

We believe the challenges outlined in previous sections cast some doubt on the ability of an NTI-supported partnering effort with existing Russian incubator organizations to significantly increase employment of scientists at the closed cities and chem-bio institutes. Therefore, we recommend to NTI a limited demonstration program aimed at

producing success at a single nuclear city and at one or two chem and/or bio sites. This will minimize NTI's investment, should the effect on business formation and employment of scientists prove to be limited.

If the recommended demonstration program were successful, the process we recommend can provide a basis for expansion of the effort to other WMD sites at little additional cost to NTI. A successful demonstration program should encourage local, regional and Ministerial financial and in-kind support for extending NTI's proven approach, and the fully-trained Russian mentors from the initial demonstration sites can serve as trainers for new mentors at new incubator sites.

We believe it will be necessary for NTI to establish a mentoring and management headquarters in Moscow, in addition to the several high-tech accelerators in the "field." This Moscow facility should be located at a Moscow area technopark in order to provide a realistic training facility for senior western mentors to train Russian mentors brought in from the field. This Moscow facility will have several missions:

- provide the overall project management for NTI's business acceleration efforts
- serve to maintain relations with supporting institutions and Ministries in Moscow, and at field locations
- arrange for legal and other consultants needed by the field offices
- provide a Moscow training site for mentoring and project management training
- schedule training opportunities for Russian entrepreneur-mentors with western mentors and at western business accelerators
- provide a continuing marketing presence to Russian and western firms for projects in development at the field locations
- coordinate possible assistance and support for this program from Russian and other western institutions and agencies active in the nonproliferation arena
- provide overall accounting and approval for expenditures of NTI funds at all sites

Each of the remote sites to be selected for the initial demonstration program should be one that NTI judges to be the most favorable of its type for the successful implementation of a business accelerator process onto an existing technopark or innovative development center. The effort at the selected closed nuclear city should not go forward without a written agreement for cooperation between NTI and Minatom to, among other things, facilitate rapid site access for mentors and other essential business accelerator personnel. At all sites, NTI should try to leverage its prospective investment through negotiations with officials of regional and local administrations to try to reduce the cost to startup businesses graduating from accelerator into the local economy.

Implementing the Business Accelerator Option

An essential missing element for the startup selection process is a survey of the match between western market needs and Russian technologies available at the remote locations. Although we were told by several individuals that the US national labs had conducted a survey of technologies at the closed cities, we found no such reports. Nor did we find any systematic attempts to match "technology push" from the closed cities to western (or even Russian) "demand pull" markets. This, we believe, is a task best performed by one of the Moscow-based "technology mining" venture capital firms, preferably one with good access to the closed cities as well as chem and bio experience. We estimate the cost of a one-time, two-month study attempting to match "technology push" and "demand pull" at a representative sample of the remote cities and chem-bio institutes at $100,000. We believe NTI should contract immediately to have this study performed, so the results can be used to support its choice of demonstration sites.

We estimate that establishing a small Moscow coordination office in conjunction with an existing organization involved in promoting employment at the target locations should require a capital investment of between $50,000 and $100,000. We further estimate that each of the two or three remote sites could require a startup investment of between $50,000 and $100,000 in renovations, communications, and equipment. In return for NTI's initial and continuing investments, we would expect the technopark operators to provide space for NTI's support staff rent-free. The exact requirements and costs, of course, would be the subject of negotiations between the NTI and the technopark operator and related Russian institutes and Ministries, if any. We believe NTI will need to hire an Interim Contractor organization for a startup period of six months to a year, to oversee the establishment and initial operations of the demonstration program. We estimate the cost for this at between $550,000 and $750,000. This estimate includes the cost of establishing the Moscow coordinating office as a "separate legal entity" should NTI wish to do so.

NTI's Moscow office will have to arrange for legal and accounting assistance (company formation, contracting, IP, etc.) from either a Russian firm or the Moscow branch of an American firm. This is likely to take the form of a retainer and hourly fee; for the first year or two, we believe $350,000 should be an ample allowance. This should cover due diligence efforts prior to startup, and contracting, IP protection, and legal advice to startups during the first year or two of operations. Russian firms will always be given preference.

The most expensive assets to acquire will be the entrepreneur-mentors, both Russian and western. We have been assured that many young Russian entrepreneurs are available, as a result of the 1998 Russian financial crisis, but these will not immediately fill the requirement for a mentor who has already achieved success, and knows the ropes. We estimate the cost for each junior mentor-entrepreneur drawn from the Moscow area at $75,000 per year. Each Russian mentor will spend about half-time on site at a remote location initially. For the balance of his time, he will receive on-the-job training both from western mentors at the Moscow facility and from short-term visits to western business accelerators. Ideally, some of the junior mentors would have some physics

training, and others, training in chemistry or biology; all should be reasonably fluent in English. The Russian mentors should be encouraged to take small equity positions so they feel they have a stake in success.

Successful and experienced senior mentors will have to come initially from western countries, principally the US and Western Europe. They will train both the junior Russian entrepreneur-mentors and the managers of startup companies at the remote sites, principally by telephone and internet interaction with and through the Russian mentors as well as by occasional site visits. Some mentors might possibly be available from such US sources as the Service Corps of Retired Executives (SCORE) and the International Corps for Executive Assistance (ICEA), although few will have much Russian business experience. Attracting senior mentors from European incubators is another possibility.

Provision of roughly two man-years of mentor-consulting effort by three to five experienced western mentors will cost up to $500,000 per year, not including travel and per diem. This level of mentoring would suffice for the first year or two for two sites; program growth and/or addition of a third site would probably require another one or two part-time senior mentors. A critical task for the senior mentors, in conjunction with others, will be to assess the commercial practicability of proposed startups at the closed cities and chem-bio institutes. Senior mentors may also want to be permitted to take equity positions in some of the promising startups.

Altering Technopark Incentives

The preceding section outlines the basic plan to address two of the major deficiencies previously identified: the lack of good project management skills and the inability to identify prospective markets for Russian high-tech development proposals. The two remaining major issues are the lack of startup capital and the lack of incentives for growth and graduation of companies being "incubated" at current technoparks.

To address these latter issues will require a combination of incentive programs and forcing measures. First, we believe that NTI should establish and make available two small funds to support the success of the demonstration. The first would be a "seed capital" loan fund to make small loans to the most promising of the entering startups to enable them to develop western-style business plans and seek other sources of equity or debt funding including venture capital. The senior entrepreneur-mentors would have primary responsibility for assessing the proposals from startups, probably in conjunction with an outside board of advisors, prior to NTI's commitment of startup funds. This is a high-risk fund. Although technically "loans," such "seed-capital" disbursements are unlikely to be recovered from firms that fail to grow sufficiently rapidly to generate a significant profit flow. We would recommend either subcontracting the operation of this fund to, or partnering with, a third-party western financial group, which would make lending decisions based on inputs and advice from NTI's senior mentors.

The second fund would provide "transition funds" to graduating firms, to help defray the added initial expense of moving from the incubator to the civilian economy. In return for such funds, NTI could either take a small stake in the startup or make a loan. The

technopark operator should receive a "graduation bonus" or a cut of the stake in the graduating startup, as the payoff for successful incubation. NTI should work with local and regional authorities to try to reduce the higher operating costs incurred by graduates, perhaps by creating incentives like "tax abatement" zones or some type of low-cost "Light Industrial Park" to house graduates.

We would suggest a total fund commitment of $500,000 in each fund initially, with individual funding amounts ranging between $10,000 and $30,000. If the demonstration program is successful, it should attract the attention of Russian and western venture capital funds, easing the requirement for NTI to provide seed capital and transition funds. Indeed, it may be possible for NTI to partner with one or more existing venture capital funds from the beginning, cutting costs and spreading risks.

For the incentive program to work, NTI will have to have a written agreement between itself, each new startup company and the technopark operator. This agreement should specify terms and conditions for both startup and technopark operator, to include increasing rent payments by the startup each year, a time commitment for incubation governing the maximum length of stay of each new startup, and a set of interim progress milestones. This agreement is discussed in more detail in the main body of the report.

Cost To, and Commitment By, NTI

We believe NTI must be prepared to support the demonstration program for a minimum of five years, in order to determine whether or not the business accelerator approach is having the desired effect on the formation of small-to-medium firms and the employment of scientists at the closed cities and chem-bio institutes. Although we would expect the demonstration program to begin to launch new firms by about the end of year three, it will take additional time to see whether these new firms can continue to grow outside the incubator environment.

Detailed cost estimates are contained in an appendix to the main body of this report. In overview, we believe the recommended demonstration program will require an initial startup investment of between $1.2 and $1.6 million (including full funding of the "startup fund"). The exact amount will depend on the extent of facility upgrades NTI chooses to support at the Moscow coordination facility and the two remote sites, and the cost and duration of NTI's contract with its Interim Contractor. The "transition fund" will need to be put in place during year two or three, requiring another one-time commitment of $550,000.

We project annual operating costs rising from roughly $1.5 million during the first year to between $2.0 and $2.5 million per year at steady-state operations, for two remote sites plus a Moscow coordinating office. Addition after year one of a third remote site to the demonstration program would add another $400,000 to $500,000 to the above annual operating costs.

As the junior Russian entrepreneur-mentors gain mentoring skill and experience during the demonstration program, it should be possible to cut back on the use of the single most

expensive component -- the senior western mentors. This will require placing greater responsibility for additional Russian mentor training (of replacements as well as for possible program expansion) on the initial cadre of (by now well-trained) Russians. We believe this is the way in which the demonstration program, if successful, can be transitioned over time to become an all-Russian undertaking, including responsibility for financial support.

Section 1.
BACKGROUND

Introduction

This report addresses two related issues regarding enhancement of the employment opportunities for Russian scientists who formerly worked on programs to develop weapons of mass destruction (WMD) at the closed nuclear cities and chemical and biological institutes. In March 2001, the Sam Nunn School of International Affairs at the Georgia Institute of Technology (Georgia Tech) hosted a group of 44 Russian scientists, ministry officials, NGO researchers, and Duma legislators for a week-long seminar that included former Senator Sam Nunn's annual Policy Forum. The subject of this year's Policy Forum was "Russian Scientific Talents: Economic Opportunities and Challenges."

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Appendix D of this report expands on this brief Introduction. It reviews the methodology behind our study, lists the organizations we met with, and includes the schedules from our trips to Russia.

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In the next few sub-sections of this Report, we provide some general background information on innovation in Russia that collectively sets the scene for a discussion of high-technology business accelerators. These topics include:

- The continuing proliferation risk represented by under-employed scientists at the closed nuclear cities and former chemical and biological weapons institutes;
- Problems in promoting innovation, especially for high-technologies, in Russia;
- The general climate for doing business in Russia today, and
- Major differences between the Russian closed cities and the chemical and biological institutes.

The Brain Drain Concern - The Risks Are Still High

Russia has the world's largest stockpiles of fissile material and nuclear weapons. The scientists that developed and supported Russia's weapons of mass destruction programs are considered to be world class. They enjoyed elite status under the Communist system. Since the collapse of the Soviet Union, the scientists in Russia's WMD facilities have seen their income and working conditions deteriorate. Deteriorating living and working conditions increase the risk of defections of WMD scientists to countries of proliferation concern.

Recently, the Carnegie Endowment for International Peace's Nonproliferation Project published a report titled, "Russia's Nuclear and Missile Complex, The Human Factor in

Proliferation."[1] This report highlights the economic plight of Russian scientists in the closed nuclear cities. While it does not address the situation for chemical and biological institute scientists, available evidence points to a similar degree of risk.

Several key statistics from this report are highlighted below:

- "40% of respondents believe that negative changes in personnel composition at their enterprises have already adversely affected the country's nuclear security, and 53% think such an effect will be felt in the near future. Only 6% of respondents believe that changes now taking place will not affect Russia's nuclear security."[2]

- "The level and structure of pay (in US dollars) received today is practically the same as in 1992, although the cost of living has risen considerably since then. About 60% of surveyed specialists receive monthly pay equivalent to less than US$50, and only 3% receive US$100 to US$125. Average income per family member amounts to about US$46 and is nearly the same in all types of cities."[3]

- "Unemployment among working age residents of closed cities is 10%."[4]

- "The 1990s saw very serious negative changes in key personnel. Not only was there a reduction in the percentage of staff members holding an academic degree, but the source of their degrees also changed."[5]

- "Eighty percent of surveyed experts would be willing to work in the military industry of a foreign country." [6]

- "To leave a closed city today means, in effect, to lose one's housing (nearly 90% of surveyed specialists live in separate apartments). The opportunities to sell it are at best limited by a low effective demand, and in addition, in most cases, housing belongs to local enterprises. This circumstance is a major restraint on the outflow from closed cities."[7] The Moscow City Government has maintained the Soviet "propiska" system of registration to live in the city. It is virtually impossible to move to Moscow.

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1 Tikhonov, Valentin. 2001, Russia's Nuclear and Missile Complex: The Human Factor in Proliferation. Pgs 2-16.
2 Ibid. Page 11.
3 Ibid. Page 9.
4 Ibid. Page 8.
5 Ibid. Page 8.
6 Ibid. Page 10.
7 Ibid. Page 9.

Innovation and Business Formation in Russia - Why Such Limited Results?

One important way to create employment opportunities for scientists at former WMD facilities is to promote high-technology innovation. When discussing the issue of high-technology business development, it is important to note the stark differences between US and Russian histories of innovation and their relevance for today.

In Lewis Branscomb's essay, "Social Capital: The Key Element in Science-Based Development", he states, "…this is the secret of American success: natural endowments and a culture that admired the practical and innovative. US science bloomed early in the culture…it flourished in a home-grown style strongly imbedded in invention and technology."[8]

Russia does not enjoy a rich cultural heritage of innovation. While most would point to Communism as the problem, the general population's indifference to central control and the government's tendency to be unstable have their roots deep in Russian history. During the 17th and 18th centuries, innovation was tolerated but certainly not encouraged. Maintaining order and control over the peasant population was the primary preoccupation of respective leaders, not "exploiting the countries resources or developing productive capacities." Russia has typically been plagued by "ritualism and rigid formalism, enforced by a centralized, hierarchical administration wholly subordinate to the needs of the temporal authorities." Pre-communist Russia was plagued by, "arbitrary imprisonment and confiscation of property" and "the judicial system offered no adequate protection", there was "limited freedom of movement." There was an "absence of a stable and coherent system of law" [9] and no means to enforce laws that did exist. When the Soviet Union collapsed in the early 1990s, Russian leaders had no model of a stable political and economic system to fall back upon.

Since the demise of the Soviet Union, millions of dollars have been spent by western government organizations, academic institutions and NGOs in an effort to support technology commercialization and general innovation in Russia, yet there is little to show for this investment. For a detailed overview of the programs please see Appendix B. - "Various Western Programs Aimed at Innovation Problems in Russia". Below is a summary of the common reasons cited for the failure of innovation projects to date, compiled both from our readings and from firsthand interviews in Russia. They are presented in two subcategories – those issues unique to Russia's circumstances, and those that have resulted from western approaches that failed to take Russia's unique cultural, political and economic conditions into account.

Uniquely Russian Obstacles

Economic/Political

- Political instability

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[8] Branscomb, Lewis. "Social Capital: The Key Element in Science-Based Development". Raymond, S ed. Science-Based Economic Development: Case Studies Around the World. 1996. Pg 1.

[9] Raeff, Marc. Understanding Imperial Russia. Columbia University Press; New York. 1984.

- Weak macro-economic policy structures and regulatory frameworks ("German Gref, the Minister for Economic Reform, reckons that bad regulations cost the country 167 billion rubles ($5.7 billion) a year.")[10]
- Lack of transparency in judicial system and lack of legal protection for investors
- Bureaucratic administrative structures ("Life at the top is about hierarchy, connections, influence-peddling and crisis management, not about organization, forethought and planning.")[11]
- Chaotic legislative environment
  - "Irina Khakamada, a modern-minded Duma Deputy, describes the middle levels of government as a 'cesspit' of corruption and incompetence. Changing that has eluded Russian reformers for two centuries."[12]
  - Arcane system of federal, regional and local taxes, with a company having to consider, on average, over 40 taxes (incl. VAT, profit, income, road users, property, social funds/payroll, pension funds, advertising, etc.) and tax rates that can rise to over 100%.
  - Cultural reliance on massive projects requiring huge up-front capital investments.
  - Local government and tax authorities that can create numerous obstacles if they are not consulted and co-opted.
  - Payment of bribes and kickbacks is considered a standard part of doing business in Russia, as is maintaining two sets of financial records.
  - Corruption within every level of government (According to Transparency International's 2001 "Corruption Perception Index", Russia ranks 79th out of 91 countries surveyed – the 91st being the most corrupt).

Financial

- **Undeveloped and unreliable banking system - no commercial lending infrastructure.**
- **Small business managers have little experience working with financial institutions and minimal understanding of western financial organization requirements to obtain capital.**
- Lack of venture capital (VC) organizations, especially angel investors and VCs interested in funding small to medium size high-technology projects.
  - Small and illiquid stock market; initial public offerings (IPOs) are not a realistic exit strategy for investors**.**
- Completely different definitions of short, medium and long term. In Russia, long-term is one year. Businesses and financial organizations think generally in terms of months, not years.

International markets

- Lack of experience negotiating contracts with western partners

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10 "Putin's Choice: A Survey of Russia". The Economist. July 21, 2001. Pg 3-16.

11 Ibid.

12 The Economist, May 12th, 2001, "Russia's faltering economy, the glow begins to fade".

- Lack of project management experience (structuring a project with deliverables and milestones)
- Lack of knowledge of how to search for and identify investors and strategic partners, either in Russia or the west.
- Limited market in Russia for high-technology products
- Lack of understanding that a product must disrupt a market if it is to be successfully launched internationally.

Problems identified with western projects in Russia that failed to take Russian conditions into account

- Programs suffer from a lack of accountability mechanisms and concrete criteria for success for local managers under international assistance projects. There are few requirements that local organizations make significant in-kind or direct financial contributions to supplement international assistance. This approach fosters an unrealistic environment in which to promote sustainable small high-technology firm innovation.
- Russian companies and entrepreneurs are wary of any programs developed under the rubric of international assistance because so many promises have been made and so little has materialized.
- Support programs were often designed by westerners and western business approaches were not adapted to meet unique local conditions. The programs were often implemented by western consultants with little or no involvement of the Russian customer or careful survey of the real problems of the Russian entrepreneurs.
- Started from scratch without building on an existing institutional base.
- Focused on western resources without mobilizing local community, business and educational institutions.
- Western consultants were hired for short periods of time and had little or no personal or commercial stakes in the long-term success of the incubator.
- Western experts tended to have a patronizing attitude towards Russian counterparts – 'we know best and we are here to tell you how to do it'.
- Western 'experts' had little or no knowledge, experience or cultural understanding of Russian economy/business (some had no business background at all, since western consulting companies often had to meet western project cost ceilings and could not pay for top notch program managers).
- In the early to mid-90s, Russian program participants tended to have unrealistic expectations and a lack of understanding of the constraints of international assistance.
- Programs failed to cooperate with, or recognize the role of, state agencies.
- Western technology companies involved in international assistance programs tended to look for easily exported technology upon which they could make a quick return. Few of the companies were involved with a long-term perspective of investing in the Russian high-technology market.

Russian Macro-economic Indicators

While there has been significant frustration with Russia's slow pace of economic reforms over the past decade, what they have achieved, when viewed from their starting-point, is quite impressive. Over the past year, the Russian government has worked hard drafting legislation for Duma consideration. Many are hopeful that, unlike during Yeltsin's tenure, the Putin government can achieve concrete legislative reforms that can support a more favorable environment for economic development. The latest session of the Duma, which ended in July, gives credit to these hopes. Unfortunately, however, the Russian government has been at a similar point of embarking on real reform in the past and the verdict is out on whether this time will be different. Moreover, new laws lacking in administrative and/or judicial system enforcement mechanisms will do little to bring real transparency and reform. Without additional tax relief and legislation that helps to reduce barriers to economic development, innovation in Russia will remain weak.

Below is a summary of several key positive economic indicators:

- This year's establishment of the 13% flat income tax rate in Russia has resulted in a 70% increase in year-to-date tax collection. The Duma's efforts to reduce the corporate tax burden is expected to lead to a similar rise in corporate tax collections and provide a much needed boost to companies operating in Russia. (Troika Dialog Research)

- In April 2001, the Duma ratified the "International Convention on Money Laundering, Search, Seizure and Confiscation of Proceeds from Crime." While May 24th saw the Duma hold its first of three readings of a law on countering money laundering, the passage of comprehensive legislation has been delayed until the spring of 2002.[13] The Russian Prosecutor General recently estimated that $20 billion to $25 billion is laundered annually through Russian financial institutions. Estimates of Russia's 'shadow' or 'off the books' economy is 40% of the country's GDP. Money laundering, coupled with general capital flight from Russia, are estimated to have resulted in $250 to $500 billion leaving the country over the last decade. It is believed that companies will have less incentive to hide profits with the Duma passage of a lower corporate profit tax.[14]

- Before its recess in July, the Duma ratified a new land code that will facilitate the private ownership of land in Russia.[15]

- The Russian stock market trading index is up 50% year-to-date. (Troika Dialog Research)

- The week of June 15, 2001, Russia's Central Bank reported gold and foreign currency reserves at a new all time high of $33.7 billion.[16]

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13 Roule, Trifin. "Money-Laudering Laws Matter". The Moscow Times. June 22, 2001. Pg 8.
14 Ibid.
15 Ibid.

Other indicators, however, are not so positive:

- According to the Ministry of Economics and Trade, in the first quarter of 2001, one in three Russians still earned less than $100 per month. An estimated 70% of Russians polled recently consider themselves worse off under post-Soviet reforms. In addition, anti-American sentiment has grown.[17]

- Trade between the US and Russia remains relatively low at $7 billion – comparable in size to US trade with the Dominican Republic. US direct investment in Russia lags behind US direct investment in Costa Rica.[18]

- An article published May 2001 in The Atlantic Monthly, by Jeffrey Tayler, titled, "Russia is Finished", is a scathing assessment of Russia's potential for western style democratic economic development. A few highlights:
  - "It is impossible to operate a business successfully in Russia and also observe all the laws, because there are too many contradictory laws."
  - When referring to Oligarchs, Tayler says, "Thus it was their connections, rather than their entrepreneurial initiative, that made these men wealthy…"
  - "State agencies other than the Tax Inspectorate suffocate businesses and add to the mess…Opening a business involves as much paperwork and bribery as ever. The mafiya still extracts dan' from entrepreneurs."
  - "36% of the population, or 52 million people, live below the subsistence level, set at a dollar a day."

- "Corruption, if it is predictable and sufficiently modest, is simply a tax. Investors are accustomed to dealing with taxes. It is the magnitude and the unpredictability of the corruption, and the absence of secure property rights, that drag down the Russian economy."[19]

- In a recent exit interview published in the Moscow Times in June 2001, former US Ambassador James Collins highlighted problems he still saw in Russia as follows, "…poor law enforcement, inadequate defense of property rights, lack of transparency, excessive bureaucracy, and corruption combine to destroy trust in economic institutions….From our standpoint, the next months are going to be critical." [20]

Differentiation Between the Russian Nuclear Closed Cities and Chemical and Biological Institutes

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16 Ibid.

17 The Moscow Times. June 21, 2001.

18 Ibid.

19 Address by Michael Mandelbaum, February 23, 2001 to the Conference on "Russia and the International System"

20 Semenko, Igor. "Collins Says Russia Is in 'Critical' Phase". The Moscow Times. June 18, 2001.

As in the US, organizations associated with the Russian nuclear, chemical and biological weapons programs have very different characteristics. While incubator approaches are being applied currently at or near almost all institutes, each situation is somewhat unique and needs to be addressed taking the particular sectoral and regional circumstances into consideration. Our discussion below will highlight major differences among the institutes. There are several similarities, however, that were highlighted during our discussions and in our reading, including:

- Facilities in remote locations
- A privileged group in the former Soviet Union
- World class scientists
- Crumbling infrastructure, outdated equipment
- Lack of funding from the state budget
- Lack of access to markets, capital and business expertise
- Focus on technology push

Nuclear Weapons Sites

In the Russian civilian and defense nuclear sectors there is one organization clearly in control - the Ministry of Atomic Energy of the Russian Federation (Minatom). Minatom oversees all foreign activities in the closed nuclear cities, which are in many respects the functional equivalents of the US national laboratories. Everything related to international cooperation with Minatom institutes goes through Minatom's International Relations Department, which is an understaffed and underfunded bureau within the vast Minatom bureaucracy. Hundreds of projects and the travel of thousands of foreign specialists are coordinated and monitored by this Department. During our meetings in Russia in June and July, everyone indicated the need to work with Minatom if we intended to work in the closed cities.

It is important to remember that each closed nuclear city has its own set of unique circumstances and challenges. Sarov is one of the three cities under the US Nuclear Cities Initiative (NCI) program and it has been targeted as Minatom's top priority for job creation. While from the outside this would seem to imply job creation for both the All-Russian Research Institute for Experimental Physics (VNIIEF) and Avangard (a nuclear warhead production facility), and that commercialization efforts would be coordinated, this is not necessarily the case. The second major city targeted by NCI is Zheleznogorsk (Krasnoyarsk-26). Their institute has an impressive reputation and the city and regional governments have demonstrated an openness and willingness to work toward commercialization objectives. Snezhinsk (home of the All-Russian Research Institute for Technical Physics - VNIITF) is NCI's third target city.

Many Russians we talked with during our June and July meetings voiced strong pessimism about the possibilities of working effectively to promote high-technology commercialization in the closed cities. Common reasons that interviewees gave for their pessimism included (in order of priority):

- Pervasive mentality in the closed cities that the state owes them a living
- Inability to meet international standards of production
- Remote distances - poor logistics

- Access limitations
- Crumbling infrastructure and outdated scientific equipment/laboratories

We asked about the potential for large Russian industrial firms to establish manufacturing and production facilities in the closed cities in order to facilitate large-scale job creation. The typical answer was that these enterprises have little incentive to take on the added challenges of working in the closed cities, under the scrutiny of Minatom and the Federal Security Service (FSB). There are ample opportunities to establish production facilities in open communities, where their efforts receive enthusiastic, rather than grudging, support. According to a study on Innovation Management in Russia, "the weak innovation capabilities of Russian industrial enterprises and the relative isolation of the branch research institutes from industrial enterprises – have a negative impact on competitiveness and the design, manufacture and marketing of products in Russia. Indeed, these two factors could therefore be said to be the most significant obstacles to the transformation of the Russian research and development (R&D) system into the desired Russian system of innovation."[21]

Due to access problems, Western companies are also reluctant to commit significant personnel and capital resources to identify investments in the closed cities. Given all the opportunities for investment in the global markets, where economic and political risks can be mitigated and economic returns clearly defined, few western companies believe they can earn a return on their investment that warrants the risks associated with doing business in the closed cities.

Based on the degree of pessimism we heard during our meetings about the potential for investments in the closed cities, we explored the potential to establish a high-tech business accelerator in Nizhny Novgorod, the closest major open city to Sarov. Nizhny Novgorod is always mentioned as one of Russia's top performing cities and has benefited from reform oriented leadership since the early 1990s. Many technoparks and organizations dedicated to supporting small business in the region are considered moderately successful. Intel has an office in the city, which employs former scientists from Sarov and is doing well. Unfortunately, the views of several US specialists that know Sarov and its scientists very well, and the Sarov representatives we met with in Moscow, are in agreement. Both adamantly do not believe that NTI support for an accelerator in Nizhny Novgorod would be of any help to Sarov in creating jobs there. The Sarov representatives repeatedly stressed that this approach would be totally ineffective. A major reason for this attitude is that Nizhny Novgorod lies three hours away from Sarov by car over bad roads. Scientists from Sarov would prefer to take the overnight train to Moscow rather than drive to Nizhny.

In summary, while there are many challenges associated working with the scientists in these cities on commercialization projects, we believe more success in business creation could be achieved by addressing some of the common missing elements (i.e. access to

[21] "Innovation Management in Russia: A Review of Training Needs and Opportunities for Growth," Section 2.2.3, published by The British Council and the Center for Science Research and Statistics, 2000.

seed capital, business mentoring, consulting, market access – all to be covered below in more detail.)

Chemical and Biological Institutes

While in the west we tend to lump together the chemical and biological institutes, they are governed by different ministries within the Russian government and are quite different in their primary missions.

The chemical institutes are largely controlled by the Russian Agency for Munitions. Our meeting with senior officials from the Agency was very formal and serious in tone. The Munitions Agency has two primary roles – it oversees the chemical weapons disposition process at chemical institutes and it is responsible for meeting requirements of UN conventions at the biological institutes. According to the Agency, chemical institutes are primarily involved in disposition activities and are looking for assistance in increasing materials protection, control and accounting at the sites, as well as funding for purchases of disposal technology. The Munitions Agency expressed little interest in, or support for, an incubator project aimed at former chemical weapons scientists. They recommended working with the Ministries of Agriculture and Health to discuss commercialization potential at the biological institutes.

The various biological institutes are under the jurisdiction of either the Ministry of Health or the Ministry of Agriculture. In contrast to our experience with Minatom, these Russian government ministries would not acknowledge that Russia has chemical or biological scientists that formerly worked on weapons of mass destruction programs. Indeed, on hearing our objective, the Ministry of Health declined to meet with us. Ministry of Agriculture officials, although interested in NTI's objectives, would not discuss, except in very general terms, the issues of pesticides and animal toxicology.

We found from two site visits that the chemical and biological institutes in the field have much more latitude when it comes to working on commercial projects, whether with Russian or western clients, and they are eager for help.

Access Problems

Access is a serious impediment to working in the closed cities. Access is strictly controlled and foreigners must apply 45 to 60 days in advance for permission to be considered. Access for general Russian citizens is similarly restricted, although the average time to receive permission is a somewhat reduced-- typically two to three weeks. While many efforts have been made over the past two years by the US Department of Energy to reach an agreement on expedited access for key joint project personnel, these negotiations have not been successful. Minatom and other Russian government organizations have been burned on a number of occasions by western governments promising to deliver large sums of assistance to the closed cities in exchange for

facilitating access. From the viewpoint of Minatom and others, what resulted were lots of "nuclear tourists" but very few concrete sustainable initiatives and even less money.

It was clear from our discussions and our first-hand experiences that the biological institutes are not closed to the same degree Minatom facilities are closed. While according to Russian law the chemical and biological institute sites have restricted access, there is in fact less stringent enforcement of these restrictions. Our impression from the institutes we visited is that the leaders at these sites well understand that development of commercial opportunities is the only thing that will save the jobs of their scientists. Therefore, both regional officials and institute leaders have an attitude of facilitating engagement rather than trying to control or inhibit it.

Access to facilities under the control of various ministries will be hostage to both US-Russian policy disputes and shifts in the warmth of US-Russian relations. In the coming months, there will be a series of delicate negotiations on arms control and missile defense, sales to Iran, and, no doubt, other issues. If these talks break down, the Russian government could choose to reduce cooperation on nonproliferation programs with the US, regardless of their status as US Government or private sector initiatives.

Finally, Russia's FSB, both in Moscow and in the regions, plays a major role in granting access to WMD sites. The FSB has regained some of the control it lost under Yeltsin since Vladimir Putin became President. This is evidenced in several new, highly visible cases of charges of espionage over the past several years, such as the Pope and Tobin arrests, and the earlier cases against Pasko and Nikitin. These cases against both Russian and US citizens highlight the potential risks that individuals and/or organizations necessarily incur when working with scientists from formerly secret facilities. It takes openness about an organization's activities, awareness by project participants, and the full cooperation of the facility and regional officials in order for an initiative to be successful.

Differing Attitudes Towards Commercialization

There are significant differences in attitude toward new business enterprises between the nuclear and chemical and biological scientists. As one western expert put it, "They may be in the same ocean of difficulties but they are rowing in different boats." The chemical and biological institute officials we met with understand that the state is no longer going to be their benefactor. They recognize that their only chance for survival is to orient their activities to meeting the needs of the Russian and western markets. They are not looking for handouts; they are looking for serious partners. They recognize their lack of experienced managers, access to capital and access to the western market as their main barriers to making a successful transition, and they are urgently seeking support to strengthen their capabilities in these three areas. These institutes have used grants from the multilateral International Science and Technology Center (ISTC) to help navigate through the period of transition from being state to becoming private enterprises.

Section 2.
BUSINESS INCUBATION AND ACCELERATION

With the preceding section as background, we now turn to the topic of business incubation in the U.S. and Russia and provide a comparison of key incubator issues.

Business Incubation in the United States

Incubation in the US emerged from three simultaneous movements during the 1970s. The first was the attempt to use old, abandoned factory buildings in distressed areas of the Midwest and Northeast by subdividing them for small firms; the second was begun as an experiment funded by the National Science Foundation to foster entrepreneurship and innovation at major universities. The third movement arose from initiatives of several successful individual entrepreneurs or groups of investors that sought to transfer their own new venture experiences to new companies in an environment conducive to successful technological innovation and commercialization.

Incubators got their first big impetus from the US Small Business Administration (SBA), which strongly promoted incubator development from 1984 until 1987. They were established to fulfill several different goals: diversify rural economies, provide employment for and increase the wealth of depressed inner cities, and transfer technology from universities and major corporations. The National Business Incubation Association was formed in 1985 by industry leaders, and has grown from 40 members to about 1,130 today.

What is a "high-technology business accelerator?"

Georgia Tech's ATDC takes into its facility small high-technology startup businesses, and surrounds them with a range of services and supporting activities designed to help them develop within the facility and become rapidly-growing enterprises, capable of prospering in the outside civilian economy. ATDC has established criteria for both the admission of new startups, and for dismissing startups that, once admitted, fail to prosper and graduate into the civilian economy within a reasonable time (nominally three years). ATDC measures its success in terms of the number of high-tech companies that move from ATDC into the economy and continue to prosper, adding revenue and employees (within the State of Georgia.)

ATDC and Georgia Tech provide lower-cost office and production facilities, secretarial support, and basic accounting, payroll, and communications services; activities which are common to most western incubators. In addition, ATDC and Georgia Tech provide assistance with: contracting and other legal issues; raising additional capital investment; marketing; technology networking; project management and business planning mentoring; and development of a range of other necessary entrepreneurial skills. If ATDC has a "secret of success," it

probably is to be found in the extent of its entrepreneurial and business mentoring provided to the startups. Many of the scientists seeking to commercialize their technology discoveries through ATDC have had little or no business training. ATDC currently has seven full-time "entrepreneurial catalysts" (mentors) who provide one-on-one business management training (in project management, setting deadlines, operating within a budget, financing and marketing assistance, etc.) to most of the 39 startups currently in ATDC. They provide ongoing advice on business plan development and strategic planning. Of great importance is their direct consulting to the startup's management on effective interaction with venture capitalists. Each of these mentors is a successful entrepreneur who has experience in technology commercialization and/or has managed one or more startup businesses or technology ventures. These mentors still have an entrepreneurial zest for turning startups into profitable businesses, but have decided to provide counsel to startup enterprises for a period of their careers. Many of these mentors will return to management of a startup, sometimes one already at ATDC. While effective, such mentors are also expensive; more than 65% of ATDC's budget for salaries is paid to the mentoring staff.

The Business Incubator Model in Russia

Business incubators began to emerge in Russia in the early 1990s and have typically been affiliated with educational institutions, scientific research centers or regional government administrations. There are literally hundreds of business incubators, commonly referred to as technoparks, or organizations nominally calling themselves "business incubators" in Russia. Few, however, meet the criteria of a high-technology business accelerator. Russian business incubators are legal entities, either commercial or non-commercial, that provide resources to entrepreneurs starting small companies. Their primary goal is to provide infrastructure and conditions within the technopark that are conducive to promoting the development and growth of small businesses. Business incubators are defined by the Russian government as the official mechanism for state support of small-scale entrepreneurship throughout the Russian Federation (i.e., the Russian government has identified incubators to be the most effective vehicle for support of innovation).

In Russia, technoparks typically provide office or laboratory workspace at below market rates and a general administrative infrastructure (office equipment such as a copier or fax, conference room, telecommunications, etc.). Some technoparks provide access to training for business managers and consulting services related to a range of issues including legal, financial, accounting and marketing. There is no set pattern in the provision of consulting and training services. Some technoparks have worked with western organizations to jointly develop training modules and the western organizations then pay to support the training program. Consulting services for technopark companies are generally provided by local consultants, and technopark companies are typically required to pay for the services. In some cases, the technopark receives Russian government or foundation grants to help offset consulting costs. For instance, The Small

Business Support Fund of the Russian Government will reimburse a technopark company for up to 50% of consulting service fees.

Rent is the primary source of income for the majority of technoparks, whether commercial or non-commercial. In the United States, companies typically are given three years to mature in the incubator and then are required to move into the civilian economy or close its doors. In Russia, the reliance on rent to cover the technoparks' overhead means that technopark managers have little incentive to push companies out the door.

In cases where technoparks are set-up on the territories of scientific institutes, there are usually multiple underutilized buildings that could be renovated to house additional technopark companies. Therefore, before the technopark would consider moving a company out, they would try to identify additional space. In the case of the Moscow Power and Engineering Institute's Technopark, they have arranged for companies to locate production facilities on affiliated properties just outside the Moscow region at reduced rates. This arrangement works well for the Institute that receives the rent money and for the company that pays a less than market rate for the space.

On the other side of the coin are the companies in the technopark. They too have few incentives for leaving the nest. In Russia the majority of commercial organizations seek what is referred to as a "krisha" or "roof". This "roof" provides all types of security, from physical protection of property to intervening with appropriate federal and local government authorities as necessary. The technopark becomes the krisha for the small companies and retains this role as they grow. The benefits of staying in the technopark from a company's perspective include:

- Prestige of being affiliated with an institute or center of higher education
- Lower rent for space and business support services. In cities like Moscow, the value of this cannot be underestimated where Class A office space can cost $1,000 per square meter and Class B space generally between $500-$700. Small companies would never be able to afford office space big enough to have a conference room, which is provided by the technopark. Security for the host institute is automatically provided to the technopark and its companies.
- A sense of camaraderie and an environment supporting entrepreneurial initiative and innovation.
- Access to a cadre of professors
- Access to graduate students who are willing to work at reduced rates
- Lower visibility with tax authorities

The implications of these constraints on the development of Russian high-tech enterprises are clear. Where ATDC looks for graduation or dismissal of an average of 13 firms a year, and intake of an equal number of new startups, there is little turnover at Russian incubators. Over time, ATDC's approach will put many more small high-tech firms into the civilian economy, and bring in many more new starts, than a similarly sized Russian technopark. Thus, one major challenge for NTI is to alter the incentive structure at Russian high-tech incubators -- for both their startups and the incubator operators -- in order to

generate a significant increase in the numbers of commercial firms moving into the Russian economy. This approach, of course, requires that there be an adequate flow of new small Russian startups "waiting in the wings" for entry into an accelerator (technically, a good "deal flow").

The majority of companies we spoke with in technoparks were very happy with their arrangements. They have no motivation to move out of the technopark. Most companies were developing and selling products for (a subset of) the Russian market and few had set their sights on expanding sales to the west, or even more of Russia and the NIS. Most of the companies we saw are what the Russians call "lifestyle" businesses. From the Russian perspective this makes perfect sense. Under Communism people were taught to fend for themselves and they developed short-term perspectives. People would rather have $10,000 now than $20,000 a year from now because they generally mistrust that anything will come to fruition a year from now. In addition, getting too big in Russia means lots of headaches and few have an interest in crossing the threshold or have the business skills to grow and manage a large business.

Moscow State University's (MGU) technopark is a classic example of companies wanting to stay under the technopark umbrella. Two very famous companies in Russia were developed at the MGU technopark. Rambler is one of Russia's largest Internet portals and Garant is a widely used source of up to the minute information on Russian federal and regional laws. Once the companies outgrew their space in the technopark, MGU allocated space next to the existing technopark and the companies built a state of the art office building. This office building houses both companies' employees, as well as provides space to technopark managers. It has a beautiful conference facility. Smaller technopark companies benefit from having these larger companies close by because both Garant and Rambler have become active investors in MGU technopark start-ups.

The cultural and economic contexts in which technoparks operate in Russia are totally different than those in the US. Understanding these nuances is critical to the success of any incubator initiative in Russia.

Why have Russian Business Incubators Not Been More Successful?
Based on our meetings and discussions, the following common problems are generally given as reasons for the lack of success of Russian business incubators:

<u>Incubator management</u>

- Poor due diligence (i.e. technopark managers responsible for company selection often lack entrepreneurial experience and have difficulties adequately screening potential tenants based on technical, managerial, financial, and market potential. This can result in selection of weak projects/companies.)
- No concept of mentoring or nurturing a start-up company
- Lack of defined success criteria for the technopark resulting in the graduation of few companies

- Often consultants brought in by the technopark to support start-up companies have little experience, especially related to marketing in the west and attracting western financial capital.
- Managers within the technopark companies also lack business experience and need practical training in all business areas.

Incubator company personnel

- Lack of trained personnel with entrepreneurial spirit (those trained in the early and mid 90s that had entrepreneurial spirit have either emigrated from Russia or have started their own businesses).
- Lack of understanding of the need for careful selection and proper remuneration of a team of managers and employees (crony networks still play a role and company owners are still often looking to get rich quick).
- Scientists tend to lack trust in 'outside' incubators. They tend only to trust the commercialization departments that have been established at their respective institutes because they believe these internal departments will better protect their interests and will be more knowledgeable about the particular technologies, markets, etc.
- Scientists tend to focus on research and development projects without considering commercialization potential. They do not have the skills to evaluate the potential market demand for a specific high-technology. They tend to be stubborn when it comes to accepting training and the need to re-orient their R&D efforts.

Training

- Russian training is based on classical economics, and tends to be generally provided by university professors who have no western business experience and know only Soviet business models.
- Most business and managerial training done to date in Russia has been theoretical, not provided in the context of a specific commercial project.
- **Russian trainees often left seminars, classes, courses or workshops with little or no idea how to practically apply the information to their specific situation.**
- **The time-frames of most training courses were very short and did not give trainees the opportunity to fully digest the materials presented and formulate relevant questions. Russian scientists often do not recognize the need for training.**

Networking

- Lack of outreach into local or regional business communities to find additional sources of support and ensure awareness among entrepreneurs about incubator activities.
- Little interaction or exchanges of information and experience through national incubator associations and international networks.
- Lack of coordination with other international or Russian small and medium enterprise support programs

Sustainability

- Current incubators lack long-term vision; if they are funded with international grants the planning typically does not go beyond the financing period and self-sustainability models have tended to fail once international grants are withdrawn. In the cases of incubators that were run with support from western consultants, when these western consultants left, the local managers frequently did not have adequate management skills to keep the incubator running as a viable business. In the cases where new incubator companies were provided small grants or loans, when these seed financing programs closed, start-up companies did not have money to pay for rent or consulting services, thus forcing the incubator to close.
- After initial training is provided, there tends to be no ongoing programs to improve the management skills of incubator staff and tenants.

Key Incubator Issues: US – Russia Comparison

Development of a successful incubator program requires implementation of a broad set of value-added business services including business facilities, coaching and mentoring, marketing analysis, and financing assistance, to name just a few. Although incubator programs can vary greatly in terms of the scope of services and the level of assistance provided, success depends on combining these services into a cohesive program designed to accelerate the growth of companies toward self-sustainability in an efficient manner.

In the next section of our report, we highlight the key elements of US incubators, identify how the situation in Russia differs, and summarize how certain US elements could be adapted to strengthen innovation initiatives already underway in Russia's nuclear, chemical and biological institutes.

Incubator Evaluation

US Experience

The measures of success of an incubator will vary depending on the goals and objectives of the organization and its stakeholders. For instance, a for-profit incubator certainly has direct return on investment as the primary goal. Conversely, a non-profit incubator funded by a local government may have job creation at the local level as a prime goal and measure of success.

It is important for an incubator to clearly state its mission and goals and then establish appropriate metrics to be measured over time. For instance the mission statement for ATDC is to increase the technology business base in Georgia by:

- accelerating the formation and growth of advanced technology start-up companies
- supporting technology commercialization
- supporting state economic developers in attracting technology companies

Based on this mission statement, the following performance metrics are measured and tracked over time by ATDC:

- Number of member companies
    - Number of graduate companies
    - Number of jobs created
    - Annual revenue of member and graduate companies
    - Capital funding raised by member companies
    - Number of companies still in business
    - Number of technology licenses and patents
    - Number of companies attracted to the state
    - Number of graduate company IPOs

These performance measures would be typical for a technology-based incubator that has a local or regional economic mission.

It is also important to establish baseline and historical data on the incubator's program in order that its progress can be tracked along with its impacts. At a minimum, this data should include:

- Year incubator was established
- Mission statement and goals
- Funding sources
- Operating budget
- Staff size and make-up
- Facility size and types
- Rental and other revenues
- Number of applicants
- Entrance and graduation policies

Russian Experience

Few if any of the technoparks we met with had clearly defined mission statements other than to house small companies and support their growth. Metrics of success tend to be rudimentary - keeping the technopark doors open and having companies continuing to pay rent are generally seen as success. While we believe it makes the most sense to leverage existing technopark resources in Russia as partners, it will be important to help these technoparks develop a mission statement, more clearly define their goals, determine appropriate metrics of success, and track these over time.

On numerous occasions during our phone interviews in the US and our meetings in Russia, we were asked about the goals NTI is aiming to achieve and the metrics of success it will use to evaluate its work. The simple answer for our project is to identify whether the incubator model would help accelerate the process of commercializing technologies and promoting job creation for Russian nuclear, chemical and biological weapons technologists. The job creation does not necessarily need to be in the cities where the scientists are currently located. The metrics of success would be the number of companies brought into the incubator that graduated and remained viable commercial entities within a five-year period.

Physical Facilities

US Experience

Most incubators would describe themselves as much more than just facilities, yet implementation of appropriate facility services can significantly assist in the growth of firms and in developing a greater sense of community among member firms. An incubator should create a sense of place with efficient physical settings, intellectual stimulation, and an environment for development of personal relationships and networking among member firms, incubator staff, and service providers. Creation of such a community will promote opportunities to collaborate and to discuss business and technology issues, as well as to further business prospects for each member firm.

Key factors in achieving this sense of place are:

- Efficient, functional facilities
- On-side mentoring and support staff
- Communication services
- Shared business services
    - Interactive environment
    - Adequate parking
    - Security
    - Flexible lease terms

Russian Experience

Most of the technoparks we visited were housed in older buildings that were being renovated on an as needed basis and as funding was made available. The level of renovation varied, but generally all were western style and functional. The most important physical infrastructure to be provided by a technopark in Russia is high-quality telephone and Internet services. High-speed Internet access in Russia, especially in the regions, is very expensive but having this access and the ability to make international calls where all the parties can hear each other are essential tools for all start-up companies.

Business Coaching/Mentoring

US Experience

Although no single area of incubation guarantees the success of a firm's growth, expert coaching or mentoring of key management personnel is certainly near the top of the list. Nearly all incubator programs provide some level of business mentoring and often it is considered the most valuable service. In some cases, incubators provide this service with in-house staff, while others employ outside mentoring consultants or receive support from volunteer business mentors. Some, such as ATDC, use a combination of both in-house and outside volunteer mentors.

ATDC's mentoring program is integral to the operation of the incubator and is the largest budget item for its operation. Each company is assigned a Venture Catalyst (VC/mentor) based on the business area of the firm (such as telecommunication, software, etc.) This VC is a full time staff member of the incubator and has an entrepreneur background in

addition to at least a master's level business or technical education. Each VC is assigned to no more than ten firms to ensure individual attention can be given to each firm. The VC is responsible for establishing and maintaining a close relationship with the firm's management team and for helping to drive the growth of the firm to self-sustainability as quickly as possible through a number of methods, including:

- Providing one-on-one business operational advice
- Developing key milestones and strategic plans for the firm
- Providing assistance with marketing analysis and strategy
- Networking with angel and venture funding sources
- Providing a link to appropriate business services such as legal assistance

In addition to the mentoring provided by the VC's, ATDC has recruited outside successful entrepreneurs for one-on-one coaching of member firms under a program named "entrepreneur-in-residence." To participate in this program, experienced entrepreneurs agree to spend at least one day a week working with member companies on a voluntary basis. This provides a method for successful entrepreneurs to "give back" to the technology community.

Another approach to business mentoring often used in the US is providing a "shadow board" for each member firm. In the case of the incubator at the University of North Carolina, Charlotte, use of a "shadow board" is mandatory. This type of board does not have direct authority over the firm's operations, but does provide for more formalized group advice sessions compared to one-on-one mentoring. A "shadow board" generally consists of a successful entrepreneur and other "experts" such as lawyers, venture capitalists, etc. depending on the specific needs of the firm. Incubator staff are generally not a part of such a board, but do assist the company with logistics for interaction with the board.

The Boulder Technology Incubator (BTI) in Boulder, Colorado also uses shadow or advisory boards for each member company as an integral part of its operation. This incubator utilizes a seven-step process dubbed the "Entrepreneur Success Model" that is customized to the needs and level of experience of the company. The seven steps of this model are:

1. Initial Screening - Conducted by incubation program management with companies expressing initial interest in the incubator, this process culls out any firm that would not be a match for the incubator's resources and company mix.

2. Admissions Committee - Composed of existing advisory board that are qualified to assess each particular company, this committee takes a hard look at the business plan, the entrepreneur's resources, goals, sales and other characteristics, and shepherds the company through the entire Entrepreneur Success Model program. Each client is also appointed its own advisory board, tailor-made from the BTI's large advisory pool.
3. Product Development - The advisory board works with the company to analyze, improve and further develop its product or service.
4. Market Development - The advisory board helps the company hone its marketing analysis and marketing strategies.
5. Organizational Development - The advisory board helps the company develop its management team, corporate structure and board of advisors.
6. Financial Development - The advisory board examines all cash flow statements, pro formas, business valuation and financial assumptions.
7. Client Funding- The advisory board determines if the company is ready for its initial capital investment. The team here consists of experienced investors who prepare the company for the due diligence process.[22]

Russian Experience

While the concept of mentoring is generally understood by technopark managers in Russia, it is understood in theory but is not applied in practice. None of the technoparks we visited had any type of mentoring programs. However, when we raised the subject for discussion, technopark managers were quick to identify the need for mentoring and believed a combination of western and Russian mentors, working with incubator companies, would greatly improve opportunities for success. Russian technopark managers generally thought western mentors would be most helpful identifying market pull opportunities (i.e. identifying potential western companies to work with, supporting marketing initiatives, etc.). Technopark managers also emphasized the need for managerial training in the context of a company's projects because it was difficult to translate general business training into actual practice.

There is no culture of volunteerism in Russia. Soviet citizens were focused on taking care of themselves and in many cases, especially in the regions, on basic day-to-day survival. While people are willing to help extended family members, the notion of donating one's time to help strangers is still a relatively new concept. In the past several years, however, some Russian businessmen have started giving back to their communities. Club 2015 was recently started by a group of young Russian entrepreneurs based in Moscow who are interested in promoting transparency and corporate governance in Russian business and generally promoting a stable economic environment in Russia. The practical goals of the group (as articulated by Andrei Arofikin from Credit Suisse First Boston with whom we met in July), are: "introduction of productive and positive norms and values, such as trust, responsibility and personal freedom; introduction of productive models for social interaction, such as consensus building; and education of young leaders." Club 2015 established the National Project Institute as the vehicle to help the group achieve its goals. Members of Club 2015 may be willing to volunteer

[22] Best Practices in Action. National Business Incubators Association. 2000.

their time to work with incubator companies in a mentoring capacity or become part of the incubator's strategic advisory board.

Identifying Russian mentors will be difficult because Russian businessmen with entrepreneurial spirit have typically already started their own companies and are focused on making money and growing their own companies. There is no mature, easily identifiable set of Russian entrepreneurs to work with, especially in the regions. While the ruble crash in 1998 left a number of bright and talented young Russian businesspeople out of work, most have had only a few years of practical business experience. Thus, identifying and attracting Russian mentors to work in the incubators will be challenging. A high salary will be needed to have potential candidates consider involvement in an incubator project, but it will be the other financial incentives made available that will provide the incentive to commit to the work. An arrangement will be needed whereby young Russian mentors will have the opportunity to take equity stakes in the incubator companies.

Identifying western entrepreneurs with experience in Russia that would be interested and willing to sign-on to the project will also be challenging. Once again a combination of an attractive salary or consulting fee, and the ability to receive equity stakes in the incubator's start-up companies, will be needed to attract high-quality western mentors.

Financing Companies in Incubators

US Experience

Even the best business plans with companies that have expert management at the helm will fail without adequate financing. A company can obtain capital financing either in the form of equity or debt, or a combination of the two. Incubators usually assist member companies in identifying potential sources of capital, establishing contacts based on an existing financial resources network and by helping with the development of presentations to be made to these financing groups. However, in some cases, incubators have established in-house capital funds to provide "seed capital" of less than one million dollars. The Arizona Technology Venture Fund established by the Arizona Technology Incubator (ATI) is an example of an in-house fund. This fund invests $25,000 to $60,000 for start-ups primarily within ATI. Although "seed capital" generally refers to funding from $100,000 to one million, it is generally provided in amounts below $250,000 and is often combined with other funding sources.

Sources of equity financing and the range of funding levels vary greatly. These sources include personal funds or funds from family and friends ($1,000 - $100,000+), corporate partnerships ($25,000 - $1,000,000+), Angels ($10,000 - $500,000), and venture capital ($500,000 - $3,000,000+).

Personal and family/friends funding is often a first and necessary source of start-up capital. Even if other options are feasible, most outside investors will want to see some level of commitment from the owners. Companies looking for seed-capital, especially those with new business ideas or technology, nearly all must depend to some degree on this type of funding from a personal network.

Corporate Partnerships, sometimes referred to as strategic clients, are an excellent source of start-up capital. Corporate partners will generally provide support in exchange for a variety of options including a licensing agreement, equity sharing, or revenue sharing. Corporate partners also can be the first client for the start-up and assist with product or service testing.

Angel investors are often involved in seed funding prior to professional venture funding. Angel investors tend to be wealthy individuals who invest in privately held companies in exchange for equity stakes. Often they will serve on a board of advisors and also assist with client growth and future venture funding. Angels will usually want a company to have a well thought out exit strategy before making an investment commitment, but may be more patient than a venture capitalist.

Venture capitalists (VCs) are professional investment managers investing institutional money in alternative assets. They typically form limited partnerships with institutions (pension funds, corporations, universities) with an average investment life of 10 years. They make initial investments for the first 3-4 years, follow on investments for 3-4 years, and then harvest their investments over the remaining 2-4 years. At the end of a 10-year fund, all investments should be publicly traded stock or cash. VCs can supply larger sums of money than other sources, but it usually comes with a high equity price tag and aggressive milestones. There are over 700 venture capital firms in the US. The types of investments they prefer vary widely.

Various types of debt financing are available to start-up companies including loans from conventional lending institutions and from community-based lending programs. A number of venture banks also specialize in financing technology ventures, such as the Silicon Valley Bank of Reston, Virginia, and the Imperial Bank of Durham, North Carolina. Venture banks often offer debt financing that is collateralized by a start-up company's intellectual property and/or equipment assets. Methods for conversion of debt to equity in the start-up may also be a part of these contracts. Community-based lending programs generally offer relatively small loans to firms being established within a target area of a community.

Some incubators have also established methods of debt financing for member firms such as at the Idaho Innovation Center (IIC). The IIC has a one million dollar revolving loan fund that is available to companies related to the IIC in amounts from $1,000 to $250,000. These loans may be used for equipment purchases or other needs, but may not be used to pay off existing debt. In addition, this fund requires that the company be located in the same county as the IIC and that it has received a turndown letter from a conventional lending source. Another example of debt financing by an incubator is the bridge loans (transition loans) available to companies at the Incubator for Technological Entrepreneurship at Kiryat Weizmann (ITEK) in Ness-Ziona, Israel. ITEK makes available bridge loans of less than one million dollars to companies leaving the incubator and close to obtaining venture capital.

Russian Experience

Identifying financing for small start-up companies in Russia is extremely difficult; it is even more difficult in the high-technology sector where there are added risks. Sources of capital that American start-up companies in incubators take for granted are simply not available in Russia. It is difficult for investors in Russia to identify exit strategies because there is no market for initial public offerings of shares. The Russian stock exchange trades few small to medium companies. Russian managers have little or no experience developing strategic partnerships between small high-technology companies and Russian or western industrial partners.

The following list describes the primary programs/organizations available for financing start-up companies in Russia:

- One source of financing for small and medium innovation enterprises in Russia is the Foundation for Assistance to Small Innovative Enterprises (referred to as the Bortnik Fund, named after its Director). The Fund is a non-commercial state organization financed by the Russian government, which provides small loans to high-technology companies. The loans do not require collateral and are changed to grant status if a company is unable to repay the loan. Since its establishment in 1994, the Fund has financed 1,344 projects (out of 3,077 applications) for approximately $27.2 million dollars. It operates in 25 Russian regions.

  The Fund's 2001 budget is $10 million, unfortunately only 20% goes directly to companies, with the remainder supporting broader innovation projects. The Fund receives 1.5% of the funds annually allocated under the Russian federal budget for civil S&T financing. Other sources of funding include fees and other receipts from its activities. Companies seeking financing must fill out a rigorous loan application. The Fund reviews applications and disburses money each quarter. The first stage of selection consists of S&T, financial, industrial, and marketing evaluation of projects. External experts perform this review within 60 days. At the second stage, and within 30 days, projects are rated by a Tender Commission and funded. In some cases, the Fund renders financial support on a repayable basis, with an interest rate imposed on the use of budget funds that is generally half that of the Central Bank of Russia.

- The Russian Government Federal Fund for Small Business Support was established in 1994 to provide financial support for small companies in 75 regions across Russia. It is much smaller in scale than Bortnik's Fund and is not oriented toward high-technology innovation. The majority of this Fund's activities are in the Moscow region. They claim to have a well-established micro-lending network through Russian credit unions. They have a system for guaranteeing loans and they also support leasing activities. They provide some business training but their limited annual budget from the Russian government is spread very thin.

- Micro-lending is growing in Russia and is most advanced in the agricultural sector. USAID has a very successful micro-lending program. The loans are, on average, $2,000 to $3,000 and can go up to $5,000; collateral is not required. They have an

excellent success rate (over 95% of loans are repaid on time and in full). The Women's Microfinance Network runs a fund of one million dollars and provides loans up to $2,500 but on average $500, to help women entrepreneurs start small businesses. They do not have a high-tech focus. The European Bank for Reconstruction and Development (EBRD) also has an active Small Business Fund (SBF), and has recently been working with the Nuclear Cities Initiative to establish micro-lending in the closed cities. The Fund works through a network of local banks and extends microcredits from $100 to $30,000.

- The Russian venture capital (VC) market is still in its infant stages of development. Typically, VC funds in Russia are looking to invest in well-developed companies, that have proven track records and are recognized leaders in a market segment. There is little, if any, Angel investing in Russia because the risks are still perceived as prohibitive. This is especially true when the problems of access and dual-use, found in nuclear, chemical and biological institutes, are added.

  While a Venture Capital Association was established in St. Petersburg, there are still no official statistics on VC activity in Russia. According to the Association's Director, there are about forty venture capital management companies operating throughout Russia that have total capitalization of approximately $2.5 to $3 billion. Of this, $500 million is committed and an estimated $500 million is invested. In October 2001, the Association will hold its Second Russian Venture Capital Fair in St. Petersburg.

- There are cultural issues associated with financing in Russia. Russians typically mistrust banks. In the 1998 ruble crash, people and companies with money in banks lost everything. Typically, a small Russian company owner would prefer to remain small with an assured short-term revenue stream rather than run risks now that could produce higher revenues in the long-term. Russians are reluctant to give up large stakes of equity in their ventures, especially scientists who are afraid their IPR will be stolen and they will be left with nothing. By contrast, western companies are reluctant to invest unless they have complete control over the company. Commercial lending as we know it in the United States does not exist. A long-term loan in Russia is three to six months and the interest rates tend to be very high (18 - 30%).

- Leading Russian investment banks typically are involved only in very large, top tier Russian companies. The core business of the majority of investment banks in Russia is equity trading. Major investment banks in Moscow include: Troika Dialog, Renaissance Capital, and United Financial Group.

  Baring Vostok Capital Partners is one of the few financial institutions that has been able to raise money ($2 billion) for a private equity fund in Russia. Several of their investment criteria include: companies that have number one or two positions in the market, annual sales of at least $10 million, positive operating cash flow of one year, and an internal rate of return of at least 40%.

Marketing

US Experience

Marketing services performed by an incubator generally fall into two areas: market analysis and research – conducted prior to a company's entry into the incubator; and product/service marketing and promotion. Conducting thorough market research on a prospective incubator start-up company's product or service is one of the keys to successful company selection by an incubator's management. This market analysis can be conducted by a service provider and/or by incubator staff.

At ATDC, graduate research assistants are utilized to conduct market analysis on all applicant companies. Using the business plan submitted by the applicant as a starting point, the startup's target market is verified for size, pricing, barriers to entry, distribution channels, and competition trends. ATDC's criteria for acceptance requires a company to operate in a market with total size of at least $50 million and/or be growing at a rate of 20% per annum, and to develop a strategy to capture a substantial portion of this market. A number of data resources and methods for conducting this research are utilized including:

- Data from companies in the existing market (Annual Reports, Internet, etc)
- Information on the current state of technology (Internet, publication databases, etc.)
- Market databases accessed through market research firms
- Interviews with potential clients
- Interviews with industry experts

The second area, product/service marketing and promotion, is generally not a service performed directly by incubator staff. Incubator staff usually only assist a member company in locating and securing the services of a professional marketing firm. Of course, some indirect promotion is usually provided by incubators, including assistance with participation in trade shows and exhibitions of member companies at Venture Forums and other events. For example, ATDC holds an "open house" each year to honor graduating firms and to showcase all member companies.

Russian Experience

The whole concept of marketing and promotion did not exist under the Soviet system. Given that there was one customer, the state, there was no need to conduct research about customer base, market competitors, pricing, etc. After the collapse of the Soviet Union, the general understanding of marketing in Russia was limited to print and media advertising. The concepts of product positioning, competitive advantage, and strategic market placement of products or services were foreign and remain poorly understood even today by most small company managers. While a large number of western and Russian marketing and public relations (PR) firms have opened over the past decade in Russia, most have focused on the retail sector and consumer goods placement, with little or no expertise in industrial or high-technology marketing. Most PR firms are based in Moscow and the western firms charge high rates for their services.

It is extremely difficult, even today, to conduct accurate market research in Russia. Under the Soviet system, statistics were developed based on an enterprise's output as stipulated by each five-year plan and rarely reflected actual data. Cost and production information were always closely held secrets under the Communist regime and the suspicion on the part of organization managers when asked for information still exists today. There is a great reluctance by Russian private companies and state organizations to provide accurate data. While the Internet has made the gathering of market research much easier, the Internet is still not a widely used tool in most of Russia's regions. Neither small start-up companies nor incubators have adequate funding to subscribe to expensive information databases.

A very important aspect of an incubator project in Russia would be the need to include intensive marketing support to company managers in the context of the technology they are developing. This is true for access to both Russian and western markets.

Training and Educational Services

US Experience

Training and education services are an important component of any incubation program. These services can be accomplished in many forms and be conducted by incubator staff, outside service providers, professional trainers, and by the entrepreneurs themselves.

There are a host of organizations in the US that specialize in business and entrepreneurial excellence training. One of the most respected non-profit organizations is The Ewing Marion Kauffman Foundation's Kauffman Center for Entrepreneurial Leadership. This Center is focused only on domestic US programs but the depth and breadth of its activities is impressive and its training modules might be an excellent resource for an NTI incubator project. The Kauffman Center strives to "be a catalyst for stimulating entrepreneurial leadership; researching, identifying, teaching and disseminating the critical skills and values that enable entrepreneurs to succeed; introducing young people to the excitement and opportunity of entrepreneurship; and encouraging others to support entrepreneurship." The Center has also established some virtual resources. At www.entreworld.org – Entreworld, entrepreneurs can review the variety of web-based resources providing information on starting and growing businesses and those supporting entrepreneurship. The website offers the best information on key aspects of business development and connecting to other targeted sites on the web. The Kauffman Center has worked with the University of California at Los Angeles to develop a clearinghouse for information on entrepreneurship and entrepreneurship education which can be reached at www.celcee.edu. These types of resources, modified and tailored to development of small and medium high-technology businesses in Russia and to the specific needs of Russian entrepreneurs, could be valuable virtual tools. We discussed opportunities to tailor US entrepreneurial training to the unique Russian situation with Ray Smilor, former Director of the Kauffman Center for Entrepreneurial Leadership and former Director of the Incubator affiliated with the University of Texas, Austin. He is now with the Foundation for Enterprise Development and is responsible for developing their international outreach efforts. He has extensive experience working in Russia. The Enterprise Development Foundation recently completed a set of training

programs on business development in Ukraine, sponsored by USAID and is interested in expanding its work in Russia. We believe Ray Smilor is an excellent resource on training and educational resources, specifically as needed in Russia, and would be a valuable consultant on a team for the incubator demonstration project.

Russian Experience

There are numerous companies in Russia that claim to provide business training both in Moscow and in every major regional city. The problem we have found, however, is that most of these organizations use Soviet economics materials as the foundation for their training. While these materials have been augmented with some textbook information on western business and management practices, few if any of the trainers have practical western business experience. There are some western companies operating in Moscow that provide business training but the services are very expensive. More importantly, the trainers are teaching short-term theory based courses and trainers often have little or no practical business experience. While the course materials can be excellent, the business managers who have taken the courses complain that they find it difficult to translate the theoretical materials into help with their day to day operating difficulties.

Legal Services

US Experience

Start-ups require a number of different legal services such as incorporation, development of appropriate client contract documents, protection of intellectual property, to name a few. In addition to establishing a relationship with a law firm that specializes in providing these services in the technology start-up environment, it is important for the start-up to have access to general legal information.

Incubators generally assist start-ups with networking with law firms that specialize in these types of services and also with directly providing access to legal information. For example, ATDC has a number of law firms within their service provider network that offer a package of services typically needed by a technology start-up. These packages are offered at a reduced cost compared to separate purchases and include items such as:

- Capitalization and Initial Set-up of Corporation
- Incorporation
- Shareholder Agreement
- Stock Incentive Plan
- Form of Investor Warrant
- Securities Compliance Guidelines
- Intellectual Property Protection
- Consultation on Restrictive Covenants
- Non-disclosure Agreement
- Intellectual Property Assignment Agreement
- Trademark Application
- Patentability Consultation
- Human Capital Protection
- Employee and Independent Contractor Agreement

- Employee Compliance Kit

ATDC also maintains an on-line library of legal information and forms for use by member companies.

Russian Experience

Unlike the training sector, there are a number of excellent western and Russian legal firms in Moscow and to a lesser extent in the regions. Western legal services are typically very expensive and there are competent Russian legal firms that can be retained to assist incubator companies on an as needed basis.

Commercialization in Russia

Challenges to successful technology commercialization from institutions in Russia are much the same as in the west, only greater in degree of difficulty. The creation of an environment for encouraging entrepreneurship, as well as providing intellectual property rights guidance, managerial training, seed capital, market research and other consulting services are all required for success. Many technoparks in Russia have done a good job developing a solid physical infrastructure for company formation and development. However, many factors have contributed to the overall lack of success of Russian technoparks, particularly in the high-technology area, and those factors have been previously highlighted.

The institutes had one customer, the state, and all activities at these institutes were directed by the state. Institutes received orders for work at prices set by the state and carried out that work with little regard for efficiency, quality control or financial transparency. Raw materials were received by state enterprises and finished products were distributed across a vast state distribution network. When competition for state contracts did arise, decisions were based more on personal relationships than an organization's ability to produce the best quality product at the lowest price. "In the FSU, strategic planning is even more foreign to defense enterprise managers. The primary reason for this is the conflict faced by these former Soviet managers as they attempt to reconcile their entrenched managerial culture, past training, and work experience with the new demands of the market….To meet the unfamiliar demands of a market economy, managers of defense enterprises in the FSU must not only adopt an entirely different set of values, skills, and goals, but they will also need to develop strategic plans to address these demands."[23] The lack of market experience has led Russian scientists to a technology push orientation as they try to commercialize technologies.

In spite of the overall lack of success, there are a few success stories from activities in the closed cities and a biological institute. Several of the most interesting examples are highlighted below:

- SPEKTR-Conversion was started by a small team of scientists in Snezhinsk who left the closed city and their institute, VNIITF. The company now employs 75

[23] "Commercializing High-Technology: East and West", edited by Judith Sedaitis, Chapter 9, "Defense Conversion in the Former Soviet Union: The Influence of Culture on the Strategic Planning Process", by Lori Coakley and Linda Randall.

people formerly working at VNIITF and has a number of commercial projects with western partners. Their primary focus of work is development of high-temperature electrical devices (furnaces), which are used for thermal processes. They are also developing orthopedic prosthesis and equipment for handicapped people. The company is working on a wheelchair cushion for prevention and treatment of pressure ulcers with the US company Numotech.

- There are a number of small companies created by teams of former WMD scientists from institutes in the Moscow region that are developing software. Three of the leading companies are Quarta, RDTEX and Luxsoft. These companies are cited as having a good team of managers, coupled with excellent programmers, and are working well with Russian and western partners that are already under contract.
- "The shabby, 30 year old building houses one of Russia's most renowned research institutes, the Automation and Electrometry Institute…Today, it is not just a basement laboratory…The institute's researchers have established eight companies to put their scientific talent to profitable use."[24]

An additional hurdle to working in the closed cities is the restriction on scientists' travel abroad. Some companies have requested scientists from closed cities to come to the U.S. for periods of three to six months for training and familiarization with the U.S. organizations practices and the requests have been denied by senior institute officials.

For a more in-depth overview of the market pull versus technology push issue, as well as a discussion of the US critical technologies list in the context of Russian technology commercialization, please see Appendix A.

[24] Financial Times, May 15, 2001, "Creaking into the Commercial World: The campus town housing Russia's scientific institutes is adapting to the market economy".

Section 3.
RECOMMENDATIONS TO NTI

This final section outlines our concrete recommendations to NTI for an incubator demonstration project. We provide details of the specific approach we are recommending to NTI to create model programs for Russian high-tech business acceleration at several demonstration sites. Following the outline of our approach, we provide both cost estimates and implementation plans for our recommended program.

The Recommended Framework for Execution of an Incubator Project

The frame of reference for our recommendations is our interest in helping NTI identify projects that can demonstrate tangible, relatively quick results and best leverage its limited financial resources. In order for a project to succeed, we believe it must be a Russian initiative, employing Russian firms, managed by a primarily Russian staff, with western expert involvement as needed. It is clear that the model of western experts telling Russians "how to do it" has failed miserably in the context of helping to solve the brain drain problem. In addition, we have carefully evaluated explanations for why the numerous incubators in Russia have been largely unsuccessful in commercializing high-tech concepts.

At each of our meetings, we asked Russian participants to identify the most important limiting factors they see to the growth of high-tech enterprises in Russia. The three most prevalent, almost universally cited, answers were:

- shortage of startup capital for new enterprises
- lack of sound project management skills and advice, and
- lack of access to, or understanding of the needs of, western markets.

All three of these limiting factors apply with special force to high-tech enterprises at closed cities and remote chem-bio institutes. All must be addressed to create a successful program. The geographic isolation of the former WMD sites introduces several further problems.

Our study focused on how to best create sustainable partnerships to promote development of new, high-tech firms involving Russian weapons technologists. After careful consideration, our team believes that strengthening the incubator infrastructure already in place in the closed nuclear cities and at chemical and biological institutes can make a valuable difference and have a multiplier effect on innovation and high-technology commercialization for Russian weapons technologists. Our overall recommendation is to undertake a demonstration project that would include a Moscow coordinating office, one field office in a closed nuclear city and one (or two) at a chemical or biological institute. Each site will have its own unique set of opportunities and challenges. The common elements to the chosen sites would be as follows:

- They would be located within an existing technopark or innovation structure that already has a management team in place.

- We would provide full support for new high-technology companies to come into the incubator, but initially would also offer support to existing firms in the technoparks, on a "time-available" basis.
- Local consulting companies would first be sought to provide services but Moscow based consultants would be used to supplement services as needed.

Moscow Coordinating Office

We recommend establishing the Moscow coordinating office within an existing technopark; it would perform the following tasks:

- Training – identify appropriate organizations to provide training, determine relevant courses, and develop training schedules for Moscow and the remote sites.
- Logistics coordination:
    - Visits by Russian mentors in the field to Moscow for training by senior mentors
    - Visits to the field sites by Russian and western mentors based in Moscow
    - Training visits by Russian mentors to western incubators
- Identification of appropriate consulting organizations to augment support provided by mentoring staff
- Screening of consulting organizations proposed by mentors at the remote sites
- Coordination of marketing activities with companies in Russia, developing countries and the west
- To the extent possible, provide existing technopark staff and companies access to the Moscow-based mentors
- Outreach with all Moscow based and international organizations that could be potential partners, including:
    small and medium enterprise foundations
    government ministries
    private financial organizations
    non-governmental organizations
    private companies

We recognize the pitfalls of teaming with an existing organization. We believe, however, that the benefits of partnering outweigh the negatives. From a financial standpoint partnering would allow resources to be concentrated on personnel rather than building a new organization in Russia. We believe a system of checks and balances can be built into the structure to promote transparency and ensure the appropriate use of project funds. In order to establish NTI's presence at MEPHI and at the incubator demonstration project's remote sites, we recommend NTI hire a western "Interim Contractor" with both Russian administrative and incubator management experience to oversee the startup. The team selected by NTI to serve as this Interim Contractor would need to negotiate with each identified field technopark organization. Contracts should have as an objective the following provisions:

- Free rent for NTI incubator project staff
- Specification of a maximum time a startup company can be housed in the incubator – three years with extension to four under special circumstances

- Specification of either a graduation bonus to the technopark operator for companies leaving after three years or a mechanism to receive a certain percentage equity stake, or percentage of future revenues, in a company

Criteria for Success

One of the most important initial tasks of the incubator project's team will be to work with partnering organizations to develop clearly defined criteria for success of the overall project. Many of the US and European government projects have been criticized for creating expectations that were impossible to fulfill. Making sure all partners in the project have realistic expectations from the outset will be to everyone's benefit. Based on experience in the US, and taking into consideration of the difficulties of working in Russia, we believe it is realistic to expect roughly one out of three companies at each incubator site to fail. By the end of year two, we would hope to have 10 to 20 companies housed in each of the demonstration site incubators**.** The overall project would be considered a success if 60% of the companies that enter the incubator leave and become either self-sustaining private enterprises in the local economy or buyout targets. We would also measure success by the depth of project-specific training received by a cadre of Russian managers, mentors and student interns.

Measurable milestones will need to be tailored to each incubator's unique situation and also for the companies in each incubator. The incubator's primary milestone will be the number of companies it graduates that are able to remain viable commercial entities in the local economy. For companies, milestones tend to be tailored and would need to be developed in close coordination with Russian and western mentors and augmented frequently. Some milestones for start-up companies in ATDC include: further development of business plan; development of marketing plan; hiring staff to fill key positions; if in prototype stage - field testing of the particular technology; establishing a strategic client relationship; stage of negotiations for key contracts or securing first round venture capital funding. As companies develop, milestones are modified to include: expanding customer base, revenue and cost performance, growth in number of employees, market share, and industrial partnerships. In Judith Sedatis' book, "Commercializing High Technology: East and West," there is a chapter titled, "Technology Business Incubators: Critical Determinants of Success" which provides additional information on performance monitoring.

NTI Advisory Board

Members of an Advisory Board would need to be identified as soon as possible and be willing to donate their time, at least initially. The Advisory Board would need to meet once every quarter. Given that it will not be possible for US Board members to always be physically present in Moscow, arrangements would have to be made for video conferencing facilities or conference call services to facilitate the meetings. The functions of the Advisory Board would be to evaluate, and make recommendations on, the business plans of companies seeking entry into the technoparks. The Board would also generally monitor the overall progress of the incubator project and would provide guidance as needed. After the initial hiring of key project personnel, the Advisory Board would continue to be involved in the hiring and dismissal of western and Russian

mentors, as well as other key personnel. The Board needs to have a balance between scientists/technology specialists, financial types and western business/market experts. It will be a challenge to identify 'impartial' board members that can put their own personal projects and interests aside and impartially evaluate work under the incubator project.

Moscow Staff

Once the Interim Contractor team has established the Moscow and remote technopark sites, the NTI demonstration project would be managed by a Russian project manager. This individual would be responsible for coordination of activities at the sites and ensuring personnel and financial resources are meeting the needs of incubator companies. He or she would also be responsible for making sure clear milestones were developed for each incubator company and that these companies were achieving identified goals. This individual would be the center of a constant feedback loop; identifying what is working and what needs adjustment, especially in terms of where western expertise is needed the most. The project manager would work closely with western mentors to expand his or her knowledge and to broaden his or her network of western market contacts. The project manager would need to be visible in the Russian and western business communities in Moscow and constantly seeking to make new contacts for incubator firms. He or she may want to identify ways to involve Russian regional oligarchs in the project, given the significant economic and political role they play in the Russian system.

The deputy project manager, and the Moscow technopark coordinator, would be a western expatriate with several years of experience living and working in Russia. The deputy project manager would be responsible for financial oversight of the project and the accountant would report to him or her. If an Independent Contractor is hired to help with the initial set-up of the incubator network (as we recommend), the western team leader of that interim contractor could be a candidate for the deputy project manager's position. This person would also be responsible for overseeing the training program and for identifying appropriate consulting organizations that could provide services to incubator companies and for negotiating the most favorable consulting rates. He or she would screen consultant recommendations from the remote sites. The deputy project manager would be responsible for negotiating a contract and for scheduling the training for all incubator staff and member company management as needed. Primary training would be provided to Russian business mentors, and incubator company managers, by the western mentors in the context of specific company activities.
The deputy project leader position may only be needed for two to three years after the demonstration project is well-established, although any decision to expand the number of sites based on early successes would create additional demands on the Moscow based team.

The core support staff in Moscow would consist of an office administrator, secretary and driver. An accountant would be hired to establish the financial infrastructure for all project sites and would be responsible for semi-annual audits at each remote site.

Mentors

Six Russian business mentors would initially be hired; two for Moscow and two for each of the remote sites. We believe there are a number of qualified candidates in Moscow who would be willing to sign-on to the project for the right salary and incentive package. Compensation would be linked to the performance of incubator companies. Many of the large western consulting firms laid-off trained Russian business people after the 1998 crash of the ruble. Many are currently working in less satisfying jobs where there is little opportunity for advancement.

We recognize that trust among strangers in Russia must be earned; it does not come automatically. Even Russian entrepreneurs hired as mentors to work in a closed nuclear city or chem-bio institute will have to spend time in those locations earning the confidence and trust of the scientists and existing technopark management. The Moscow- based mentors would serve as liaisons to the Moscow business and financial communities and would be responsible for doing market research on Russian companies. Especially in the initial stages of the project, the Moscow-based business mentors would provide services to companies already based in the technopark. They would shuttle to the regions as needed. The objective would be to develop a cadre of young Russian business mentors who not only appreciate challenges of developing new high-technology businesses in Moscow, but who understand the difficulties associated with working in the regions. Once hired, these Russian business mentors would go to the US for an intensive internship at a US incubator, such as ATDC. We recognize there is a potential for a high turnover rate among the Russian business mentors given that they are highly in demand. We believe a creative incentive package can be developed to help offset offers for higher salaries in private firms.

We have included funds in the proposal budget to hire four senior US entrepreneurial mentors who would work on a part-time basis. Two would be present in Russia at all times during the first two to three years of the project. These entrepreneurial mentors would need to have experience working in Russia or other countries of the former Soviet Union. They would need to have a solid network of western corporate and financial contacts and it would be helpful if two out of the four had technology related backgrounds. Why, you ask, would someone with these qualifications want to take this job? While the pool of candidates is relatively small, we think the upside potential they would be offered would provide an attractive incentive and could entice them to commit half-time to mentoring Russian entrepreneurs for some period of time. The Russian economy has strengthened significantly since the ruble crash in 1998 and if legislative reforms continue at the pace they have shown this year, the environment for doing business in Russia will continue to grow stronger. At the same time, there are still significant risks associated with investing in Russia; even Americans with entrepreneurial spirit very cautiously approach investment in Russian high-technology start-up companies. The NTI incubator project would help to offset some of the initial early risks, which could be attractive to potential western mentors.

The incentive package for both Russian and western mentors will need to be creative. Because of the lack of a developed stock market in Russia, the prospect of launching an

initial public offering (IPO) is unrealistic. The lure of equity, however, may still be important, in the context of the buyout of a high-tech startup company by a larger Russian or western company. Therefore, while "equity" in Russia may not have the same appeal as it does in the US, it nonetheless represents an attractive incentive. (An alternative might be to tie a mentor's bonus compensation to a company's performance and to negotiate revenue sharing after a certain number of years to be stipulated.)

Consulting Services

There is a significant range in costs for consulting services in Russia. First there is the issue of western versus Russian consulting services. We believe most consulting services can be provided by Russian consulting firms, given that rates charged by western firm are extremely expensive. It may be possible to create a scope of work for a specific job that could be put out for bid under a fixed-price contract for a somewhat reduced overall rate. Second is the issue of Russian consulting services in Moscow and those in the regions. The choices for consulting services at the remote sites will be more limited and the quality of services provided may not meet the requirements of incoming incubator companies. Therefore, Moscow consulting services will necessarily need to augment services provided in the regions. We believe a list of two to three consultants would be identified in Moscow and the regional sites for each speciality. Initially, work could be arranged on an hourly basis. Over time the strongest consultants providing consistently high-quality work could be identified and retainer arrangements could be negotiated for lower rates. The range of consulting services we believe need to be considered include:

- Legal (incoming company registration, legal structure advice, contract development and deal structuring with a Russian or western company, intellectual property consultation and registration of patents, licenses, etc.)
- Accounting (registration of new company with all relevant tax and government authorities, establishing the financial accounting to meet Russian and western standards and providing support as needed to audit accounts)
- Marketing/public relations (development of marketing materials for promotion of a company's goods and services, including logo, brochure, etc.; specialized research about western or Russian market segments; preparations for exhibitions and for road show aimed at obtaining financing)
- Purchasing accounting software that allows accounts to show both western and Russian accounts – for incubator demonstration project and for companies coming into the incubator.
- Subscriptions to Internet information sites, databases, etc.
- Subscriptions to print materials and purchase of teaching materials

Training

We believe the most economic approach to training is to identify one organization that can provide the training services to the incubator project and contracting with them on a retainer basis for an initial six months. Renewal of the contract would be based on initial service performance and feedback from incubator company managers.

Student Participation

Finally, we want to encourage student participation and identify opportunities for training students affiliated with partnering institutions or technoparks at the remote sites. The technoparks should offer (very modest) paid internships to talented students to assist both startup companies and the Russian mentors in the technoparks. This can serve to develop an appreciation for, and various skills in, entrepreneurship among the 'next generation' of Russians.

Financial Support

Our final recommendation is the establishment of two different financial funds to support incubator companies.

- The seed capital fund would need to be established immediately. The fund would provide loans to new companies to help them make small initial capital equipment purchases and/or provide funds to cover initial administrative overhead costs such as salaries and rent. We estimate the average loan amount would be between $10,000 and $30,000 and would have a three-year payback period. The loan would be provided at a favorable interest rate and would not require collateral. It would also be helpful for the fund's managing organization to establish links with several Russian banks to provide collateralized loans for capital investments to incubator companies.

- What we term the "transition fund" should be established during the second year of the project. This fund would make loans to companies that are ready to leave the technopark but that need bridge financing to transition into the 'real' economy. Loans would be for terms of one or two years at a lower than market interest rate and would require collateral, most likely an equity share. Within that year or two, the company should grow enough to attract additional venture capital financing.

- We do not recommend that the Moscow technopark coordinating office manage these funds. We think the funds should be run by an independent financial organization. Of course, both the NTI Project Manager and the NTI itself will wish to retain some authority over disbursements from the funds.

- In exchange for managing the funds for the NTI incubator project, the financial organization would want the rights of first refusal to invest in the incubator companies. We believe having an independent financial group performing due diligence on incubator companies applying for loans would serve as another check and balance for the project in addition to the Advisory Board. For example, if a technopark's project managers started to show favoritism to projects from a certain department within an institute, disparaging stronger proposals from another group, having an independent organization reviewing the financial soundness of the business plans would be helpful.

As the early results of the demonstration project are evaluated, if successes are being achieved, and NTI decides it would like to identify additional incubator sites, the incremental costs would be relatively small. Consulting companies and training partners will already be under contract and the financial infrastructure will have been established through the seed capital fund. New incubator locations could take advantage of the network of western market contacts that will have been created. The core cadre of Russian business mentors could assist with the establishment of new incubator locations and could train additional incubator staff and new company managers without the need for travel to the US.

Cost of Our Recommendations

We based our calculations on information gathered in the course of our discussions in Moscow and Novosibirsk, from additional estimates sent from Russian interviewees, and from US companies with business operations in Moscow. We have given generous fixed estimates of funding required for incubator personnel and mentors, believing these to be the keys to success, and a range of expenses for consulting and other services. The upper end of the range generally represents Russian estimates, while the lower end represents a mix of US estimates and our assessment of what hard bargaining could produce.
We have provided budget estimates for both initial investment costs and the annual costs associated with operating a fully up and running project. We have not tried to develop a budget that reflects the phasing in of costs over the first year of the project, although operating costs would be modest initially and would rise as personnel are hired.
We believe NTI must be prepared to support the demonstration program for a minimum of five years, in order to determine whether or not the business accelerator approach is having the desired effect on the formation of small-to-medium firms and the employment of scientists at the closed cities and chem-bio institutes. Although we would expect the demonstration program to begin to launch new firms by about the end of year three, it will take additional time do see whether these new firms can continue to grow outside the incubator environment.

In overview, we believe the recommended demonstration program will require an initial startup investment of between $1.2 and $1.6 million (including full funding of the "startup fund"). The exact amount will depend on the extent of facility upgrades NTI chooses to support at the Moscow coordination facility and the two remote sites, and the cost and duration of NTI's contract with its Interim Contractor. The "transition fund" will need to be put in place during year two or three, requiring another one-time commitment of $550,000.

We project annual operating costs rising from roughly $1.5 million during the first year to between $2.0 and $2.5 million per year at steady-state operations, for two remote sites plus a Moscow coordinating office. After one year, an additional site could be added to the demonstration program for an incremental operating cost of between $400,000 and $500,000.

As the junior Russian entrepreneur-mentors gain mentoring skill and experience during the demonstration program, it should be possible to cut back on the use of the single most expensive component -- the senior western mentors. This will require placing greater responsibility for additional Russian mentor training (of replacements as well as for possible program expansion) on the initial cadre of (by now well-trained) Russians. We believe this is the way in which the demonstration program, if successful, can be transitioned over time to become an all-Russian undertaking, including responsibility for financial support.

Implementing This Report's Recommendations

We recommend several measures for NTI to consider implementing both prior to its October Board meeting, and, assuming the Board approves proceeding, following that meeting. We assume NTI either will not have a sufficient presence in Russia to directly implement, or will not wish to assume an operational role in implementing, our recommended program in Russia. Instead, we assume NTI would hire one or more organization(s) to perform the various implementation tasks under NTI's supervision.

Prior to October

We believe the single most useful activity NTI could pursue during this period is to hire a knowledgeable marketing (technology consulting) company in Russia to conduct a survey at a selected number of sites. This survey should seek to:

- Evaluate technologies identified as having commercial potential by the sites in the context of the needs of companies in Russia, western and developing countries
- Identify the personnel and management strengths at each site vis-a-vis market demand for critical technologies (in the US, OECD and ASEAN countries) and for R&D services.

This sampling study should provide an answer to the lingering question of whether commercializable technologies exist at closed cities and chem-bio institutes in sufficient numbers to provide adequate "deal-flow" through more-effective high-tech business accelerators. To provide market expertise on both Russian and foreign markets, the firm chosen to undertake the study will probably have to be one headed by a western expatriate. It will be extremely difficult to find one firm that will be able to undertake a comprehensive technology survey at both the closed cities and chem-bio institutes. Most companies have concentrated on certain technologies, such as telecommunications, aerospace, software engineering, pharmaceuticals, etc. In addition, we found few firms that had a good network of contacts with US high-technology companies. We found many promoters, but few organizations that appear capable of undertaking a comprehensive technology review of market needs in both Russia and the west.

NTI will probably need to directly undertake other tasks prior to October. If NTI chooses to pursue any projects with nuclear weapons technologists in Russia, it will need to negotiate an Agreement for Cooperation with Minatom. For an incubator project, NTI would need to negotiate the terms of an Agreement for Cooperation that would attempt to

secure more favorable access conditions for incubator personnel to the chosen site. NTI will have to decide how the various offices proposed in our recommended plan will be established under applicable Russian law, and how it will structure the disbursement of its funds in Russia so as to minimize taxation. This will be particularly important for NTI to sort through, since we assume NTI will not wish to try to minimize tax liabilities by operating on a cash basis using two sets of books.

Third, NTI may wish to issue an RFP to selected organizations to solicit proposals to serve as an Interim Contractor to oversee startup operations at both the Moscow incubator and the two or three remote sites chosen. This would allow NTI to select an Interim Contractor organization shortly after an affirmative Board decision in October. If NTI waits until October to begin to solicit proposals, it will probably see no visible action on scene in Moscow until next year at the earliest. The requirements for this interim contractor are set out in the following subsection.

If a Decision is made to Proceed

The first critical decision will be to select an Interim Contractor to oversee startup operations both in Moscow and at the (two or three) remote sites chosen. This contractor will take the lead in negotiating the terms of agreements with the various host institutions, subject to NTI approval. These agreements will cover such items as:

- technopark facility upgrades to be paid by NTI
- criteria for both admission and graduation of those new high-tech firms that will be supported by NTI's operations
- identification of and negotiation with a sub-contractor to establish and manage the seed capital fund
- Identify and enter into sub-contracting arrangements with consulting service providers
- selection of technopark staff to be paid by NTI funds and
- administrative and logistics support at all sites.

The Interim Contractor should recommend to NTI potential candidates for the senior western and junior Russian mentors. The contractor should also recommend members of an independent Advisory Board that NTI will convene. This Board (which we assume will operate *pro bono* initially) will review potential candidates identified by the contractor for both the western senior mentor and the junior Russian mentor positions and make its own independent recommendations to NTI, which will retain ultimate hiring authority. The Advisory Board would also review and make recommendations on the initial proposed set of incubation companies in the remote sites.

The Interim Contractor will also identify potential candidates for the permanent project leader and deputy project leader positions and make hiring recommendations to NTI.

The Interim Contractor organization chosen will have to make available to NTI personnel with proven track records in project management, negotiations with Russian entities, administration, and business accelerator management and operations. We estimate this interim-contractor phase will last between six months and one year from a decision to

proceed, and will require a full-time effort by three people (two in Russia and one in the US) and roughly a half-time effort from two skilled individuals, plus travel and expenses.

Georgia Tech's Interest in Implementation of the Proposal

Both the Sam Nunn School of International Affairs and the Advanced Technology Development Center (ATDC) at the Georgia Institute of Technology would be prepared to assist the NTI in the implementation of the recommended program, should NTI decide to proceed.

The Georgia Institute of Technology would be prepared to submit a bid to serve NTI as the Interim Contractor to oversee and assist in the startup operations in Moscow, including the interviewing of candidates for permanent positions, and the coordination of initial operations at the remote sites. This Interim Contractor team would be comprised of experienced individuals from Georgia Tech's ATDC and Sam Nunn School of International Affairs. The team will be comprised of individuals with prior negotiating and administrative experience in Russia and with exceptional competence in the organization and management of high-tech business accelerators. The team would be prepared to assist NTI in identifying, interviewing, and recommending for hire both the potential senior western and the junior Russian entrepreneur-mentors for the NTI program, as well as serving in an advisory role to NTI upon conclusion of the Interim Contractor phase.

Appendix A.

Market Potential – Demand Pull

A major problem we identified in the course of our study is the lack of a market or demand-pull focus by the programs working with Russian scientists. Russian scientists, and many western government programs aimed at commercialization, have emphasized technology push. We undertook a survey to try to determine whether in-depth technical assessments for either the closed nuclear cities or the chemical and biological institutes had been undertaken since the collapse of the Soviet Union. While we were told that such a comprehensive survey was undertaken during the initial stages of the Nuclear Cities Initiative, this does not appear to be the case. Various organizations and/or companies may have undertaken assessments in certain technology areas at certain facilities, but we could find no evidence of comprehensive technical assessments being completed, from a market demand perspective, for any of the key nuclear, chemical or biological institutes.

It is relatively easy to talk about world-class Russian scientific talent from the closed cities and chemical and biological institutes in general terms, but specifically identifying how these resources could be brought to bear on critical technology issues in western markets is more difficult. Two types of resources can be drawn from the Russian WMD scientific community. First is intellectual capital that can be tapped for commercial projects. Second are scientists with thousands of research projects they are either working on, or have sitting on the shelf, that they believe have commercial potential. Translating either the intellectual capital or the individual research projects into concrete commercial projects has proven elusive for western and Russian government programs and for private companies over the past decade.

The Russian –American Nuclear Security Advisory Council (RANSAC) researched this topic and reviewed the US Critical Technologies List vis-a-vis scientific potential in the closed nuclear cities. RANSAC came to the conclusion that it would be very helpful for an in-depth study to be conducted examining technology needs in US, OECD and ASEAN countries with the goal of matching these needs to Russian capabilities. Our study came to the same conclusion. We strongly believe that until a comprehensive evaluation of the availability, in these closed cities and chemical and biological institutes, of technology development prospects match to what the Russian and western markets need, commercialization efforts will produce mixed results.

Information gained through technical assessments with a market-pull orientation would not only benefit an incubator project, it would serve as an important foundation of information for all organizations interested in investing in Russian scientific talent and technology. The information could be made available on NTI's website.

US Experience

Defense conversion in the US has been largely unsuccessful when scientists have attempted to make private sector modifications to existing defense technologies[25]. This type of 'technology push' model has not done well at US laboratories where incubators were established to help commercialize technology. As a result, 'demand pull' models, with targeted research and development and market assessments, have evolved as the preferred strategy for commercialization.

Both the US and Soviet systems were developed during the era of superpower rivalry and as a result policymakers purposefully sought to seclude and isolate the defense sector from the economy at large.[26] Outside of military competition with the West, Soviet research took place largely in the absence of market forces and consumer demand. Ironically, the US military research establishment came to resemble its Soviet rivals in this seclusion from consumer demand.[27] Federal R&D in the US and Russia was dominated by long-term, highly formal, development-oriented research. As such, state R&D was less involved with process technologies and general innovation than with clear and specific products and tasks, making subsequent discoveries more difficult to adapt to other applications. Whereas Russia shares both the cultural and technical obstacles to defense conversion, its difficulties are compounded by the sheer scale of the problem and more severe economic conditions.[28] In 1990, even when the flight from research had already begun, Russia employed approximately 126 scientists per 10,000 people in the labor force in comparison with 76 scientists per 10,000 in the United States.[29]

US Federal research establishments have great innovative potential, but face a "critical gap" on several levels in communicating with the private sector. The relative seclusion of the US national R&D system, and its staggering bureaucracy, tend to make the costs prohibitively high for private sector companies to partner with US laboratories.[30] In the early 1980s, the US government and the Congress began to recognize the need to shift the US national laboratories to a more commercial orientation. In 1984, the Congress established the National Cooperative Research Act, designed to promote collaboration between the national laboratories and US industry using Cooperative Research and Development Agreements (CRADAs). CRADAs are still a widely used vehicle to promote laboratory-private sector linkages and their numbers have risen dramatically over the years. But despite the dramatic rise of partnering by US labs, Japanese government labs remain the leaders with more than twice as many cooperative agreements with private firms.[31]

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25 Sedaitis, Judith B. ed. Commercializing High Technology: East and West. Rowman & Littlefield Publishers; New York. 1997.

26 Sedaitis, Judith B. ed. "Commercializing State-Owned R&D: A Russia – United States Comparison". Commercializing High Technology: East and West. Rowman & Littlefield Publishers; 1997. Pg 146.

27 Ibid, 146.

28 Ibid, 148.

29 Ibid, 149.

30 Ibid, 145.

31 Ibid, 155.

Each US laboratory, and the private organizations that manage the labs, have established commercialization initiatives, but few have been successful. There are literally hundreds of examples of small venture capital companies and incubators established over the years to commercialize technologies from the US laboratories. In 1993, for example, Lockheed Martin Corp. was hired to manage Sandia National Laboratory; it established Technology Ventures Corporation (TVC) to promote the development of spin-off companies. Lockheed initially invested $10 million and worked to attract venture capital to technology-driven start-ups from Sandia. While small companies have emerged, the anticipated large-scale commercial development and job creation has not taken place.[32]

One of the primary reasons cited for this lack of commercialization success is the absence of a commercial culture at the laboratories. In the context of having to respond only to one customer, the US state-supported research system developed a relatively inefficient bureaucratic organizational culture and set of practices distinct from the market culture developing around it. The US government did not seek to integrate the US defense R&D infrastructure with general science and technology policies promoting high-technology commercial development. In France, another country with a large military R&D budget (approx. 37 % of state research funds are spent with defense research agencies) state industrial policy from the beginning has integrated defense research programs with private sector economic goals.

Lack of competition and efficiency in product research and development hindered conversion efforts in the United States. US laboratories, and the private firms supporting these laboratories, did not feel the need to pay close attention to cost and efficiency of production of goods and services, nor did they actively seek new customers. Internal procedures had to meet staggering demands for detailed reporting, security, and specifications made by various and sundry federal and state agencies. In particular, the monopolistic structure served to mitigate the important role that competition plays in stimulating innovation.[33] The same hurdles the US government has faced in reorienting the US laboratories are found in Russia. For Russian laboratories and researchers it is important for them to recognize that the transition to becoming a more commercial enterprise involves both operational and psychological re-orientation. They can no longer depend on a central government for research grants. Scientists must learn to target their research to fulfill the needs of the market.

Another reason cited for the lack of successful commercialization at the US labs is the lack of commercial orientation among scientists. Many charge that technologists are too focused on the technical details of their work to see beyond their research to its market applications. Studies on the personal attributes of entrepreneurs find the skilled technologist less market-oriented and more risk averse than entrepreneurs in other industrial sectors. Those technologists employed by the state, in particular, are found to be older, better educated, and have longer tenure with one employer than their private sector counterparts. The implication is that the technologist personality lacks the

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[32] Schwartz, Larry. Financing the Commercialization of Russian Defense Technologies. Pg 318.

[33] Sedaitis, Judith B. ed. "Commercializing State-Owned R&D: A Russia – United States Comparison". Commercializing High Technology: East and West. Rowman & Littlefield Publishers; 1997. Pg 148.

energetic, risk-taking traits necessary for successful entrepreneurship, even when he or she uncovers commercial applications for innovation. The lack of aggressive, entrepreneurial qualities might explain the relatively poor entrepreneurial showing among technologists at US labs.[34]

Perhaps the single most important lesson from the US technology transfer experience is that market forces alone are insufficient for bridging the institutional isolation of military R&D.[35]

Critical Technologies, Russian Science and the Market

In 1995, the United States Department of Commerce's Office of Science & Technology Policy (OSTP) conducted an assessment of 'critical technologies'. OSTP defines critical technologies as "essential for the United States to develop to further the long-term national security or economic prosperity of the United States"[36]. Seven categories were identified with accompanying sub-areas. The table below shows the list of critical technologies as seen in the report.

Technology Category	**Technology Area**
1. Energy	Energy efficiency Energy storage, conditioning, distribution and transmission Improved generation
2. Environmental Quality	Monitoring and assessment Pollution control Remediation and restoration
3. Information and communication	Components Communications Computer systems Information management Intelligent complex adaptive systems Sensors Software and toolkits
4. Living Systems	Biotechnology Medical technology Agriculture and food technology Human factors
5. Manufacturing	Discrete product manufacturing

[34] Ibid, 151.
[35] Ibid, 149.
[36] Office of Science & Technology Policy. "National Critical Technologies Report". March 1994. Appendix A, pg 11.

	Continuous materials processing Micro/nanofabrication and machining
6. Materials	Materials Structures

Technology Category	**Technology Area**
7. Transportation	Aerodynamics Avionics and controls Propulsion and power Systems integration Human interface[37]

This list of critical technologies is not unique to the United States. Other countries including Japan and the European Union, have developed their own assessments and lists. In 1994, the European Commission published its report titled, "Assessment of Critical Technologies in Europe in Selected Fields Covered by the EC Research Programmes."[38]

The National Critical Technologies Report makes comparisons with Russian technologies and reveals some information about Russian research and technology capabilities. Russian scientists have strong capabilities and research experience in the areas of power generation and energy development, as well as environmental management and waste remediation.[39] Specifically in the area of improved power generation, Russia has developed advanced pulsed power techniques that are superior to those in the US, Europe and Japan. Regarding environmental management, areas such as monitoring and assessment and nuclear waste remediation and environmental restoration have shown great promise. Several joint projects are underway between US laboratories, western companies and Russian institutes looking at applicability of Russian environmental remediation technologies to US clean-up projects at sites such as Rocky Flats and Hanford. Another promising area is testing US remediation technologies at Russian sites such as Krasnoyarsk-26. Another example we learned about during our visit is a team of scientists that has developed technologies that allow specially bred worms to digest soil contaminants of industrial waste as a remediation process.[40]

With India's recent success in becoming a software programming powerhouse, many in Russia are turning to that model in the hopes that Russia too could become the "next India" (India's software exports amount to $7 billion per year and India's information technology ministry recently approved a $1.09 billion collaborative project with the

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37 Ibid. Page 3.

38 European Commission. "Assessment of Critical Technologies in Europe in Selected Fields covered by the EC Research Programmes". EUR 15698, 1994.

39 Office of Science, Technology and Policy. "National Critical Technologies Report". March 1994.

40 Gentleman, Amelia. "Wriggling Off the Hook". The Guardian. July 26, 2000.

Massachusetts Institute of Technology called Media Lab Asia).[41] Russian software engineering and programming activities to date have been promising, but remain on a relatively small scale. Companies such as Intel and Sun Microsystems are actively outsourcing projects to teams of Russian scientists; Open Computing Centers have been established under the Nuclear Cities Initiative in Sarov and Snezhinsk. Russian scientists believe their competitive advantage lies in their ability to be creative in their approaches to problem solving. Many small western companies and venture capital firms are looking for opportunities to invest in Russian software programming and engineering services that can be outsourced to the west. IXcellerator is one such company with which we met in June and our attached meeting notes highlight their activities. The American Chamber of Commerce (AmCham) completed a study in March 2001 titled, "Offshore Software Development in Russia", which examines the potential for Russia to become a leading offshore software development provider and compares the situation in Russia with India and Ireland. The AmCham Study identifies the technical skills and education of Russia's workforce as its major competitive advantage, with more personnel working in R&D than any other country in the world.

Under the "living systems" category, American experts familiar with the capabilities of biological laboratories in Russia offered their opinions about potential areas of research and growth[42]. The rate of HIV infection in Russia is increasing rapidly and as more of the population becomes infected, more domestically based research will be in demand. Additionally, drug resistant tuberculosis has become a serious public health problem and research in this area is needed. Domestically, anthrax has always been a significant concern for Russians. Vaccines available from producers in Georgia are woefully inadequate and can be harmful to one's health. Research into alternative vaccine programs could help the situation greatly.

Other peripheral interests in the "living systems" category include pharmaceuticals manufacturing. While licensing and standards make it extremely difficult to consider manufacturing pharmaceuticals in Russia for western markets, there is significant potential to meet demand in Russia and other developing countries. Currently, Russia imports a large percentage of its basic medicines from countries such as Turkey and India.

Medical equipment development and production is another large market in Russia because of the onerous regulations governing the import of foreign devices. It is much easier and faster for domestic firms to develop equipment and market it.

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41 Rai, Saritha. "Technology Incubator to Focus on India's Needs". New York Times. June 3, 2001.

42 Conversations with Dr. Jeanne Guillemin, Massachusetts Institute of Technology; Dr. Johnathan Richmond, Centers for Disease Control.

Appendix B.

Various Western Programs Aimed at Innovation Problems in Russia

Business Incubation in Eastern Europe and other States of the Commonwealth of Independent States (CIS)

Thousands of programs have been established by international aid organizations, non-governmental organizations, and local governments to support the development of small and medium businesses in the CIS. Very few, however, have focused on development of high-technology businesses. There is no evidence that the various efforts of western public and/or private aid organizations have been coordinated and success has been marginal and very localized.

In the course of our research we reviewed experiences with incubation in East European countries to identify common trends and lessons learned. While innovation centers and business support centers were established by aid organizations throughout Eastern Europe, we found very little similarity between the situations in countries like Poland or Hungary and Russia.

Support for Small Business Development in Russia

The major drawback of the institutions created by western aid organizations to support small business development in Russia is that, for the most part, they ceased operations once project funding ran out. It is difficult to accurately measure the true success of these projects because the results they claimed to achieve were often inflated.

The most active western government programs supporting innovation in Russia have been the US Agency for International Development (USAID) and the European Union's Technical Assistance to the Commonwealth of Independent States (TACIS).

TACIS has been active in the following areas:

- Establishing Business Communication Centres (BCCs) in the regions to disseminate European know-how on management, marketing and business planning, and to help producers of goods and services, especially high tech ones, meet each other.

- Providing expertise to the Federal Fund for Small Business Support and the Regional Funds for Small Business Support in the development of financing mechanisms for small and medium enterprises (SMEs) and promoting leasing businesses.

- Strengthening the resources and capabilities of the existing network of development agencies for small and medium enterprises (SMEDA). This allowed TACIS to expand the number and quality of services to be provided to the Russian SMEs, such as training and advice on taxation and financial issues. TACIS is further developing the SMEDA network through a virtual network.

- Fostering entrepreneurship by facilitating the restructuring of one-company towns through SME development in three pilot towns: Anzhero-Suzhinsk (Kemerovo region), Cherepovets (Vologda region), and Volzhski (Volgograd region).

- Supporting the Foundation for Assistance to Small Innovative Enterprises (FASIE), which provides loans to small innovative enterprises. Also supporting the economic development of Russia's huge scientific/technical resources and promoting high-tech entrepreneurship.

- Supporting the Russian Venture Capital Association (RVCA), based in St. Petersburg, with a view to diversifying sources of financing available to Russian SMEs.

- TACIS also catalyses investment into the Russian SME sector by supporting the Russian Small Business Bank (KMB) in which the European Bank for Reconstruction and Development owns a majority stake. TACIS has helped KMB establish its branch network. KMB bank is responsible for funds disbursement for the Russia Small Business Fund.

TACIS support for SME (approx. 86 cents to 1 ECU)

Year	Objectives	€	Start	End
1992	Create DAs and BCCs : Moscow and St Petersburg	6 044 650	11-93	07-97
1993	Establish network of 21 SMEDAs	3 735 295	07-94	02-97
	SME Institution building : Policy advice	936 011	10-94	03-97
	Training regional staff	50 000	04-96	07-96
1994	Strengthening network, support 5 regional SMEDAs	1 954 898	08-95	12-97
	Support network	1 200 000	10-97	05-97
	Vladimir promotion centre	1 876 794	09-95	03-98
1995	Establish SME resource centre	1 499 090	01-97	12-98
	Support network (NW) and training for women entrepreneurs	2 998 080	01-97	01-99
1996	Support network (inc new 4BCC and 4 SMEDA)	4 499 622	11-97	11-99
	TA federal and regional funds	1 798 490	12-97	12-99
1997	SME development in monocompany towns	3 000 000	12-98	12-2000
	SME Innovation audit	1 500 000	12-98	7-2000
	TOTAL	**31 092 648**		
	o/w:			
	Development of SMEDA network	22.5 M€		
	Policy advice and information	6.0 M€		
	Other	2.5 M€		

The following TACIS projects were created to support Russian high-technology business incubators and were called, "Transfer of Finnish Experience in Business Incubators, Technology Parks and Industrial Villages for the Development of Russian Incubators." The projects were completed in late 1999.

- A pre-feasibility study and business plan for development of Arkhangelsk Technology Park including High Technology Expert´s Management Training.

The partners of the project were: on the Russian side – Regional Administration of Arkhangelsk, City Administration of Arkhangelsk, Arkhangelsk State Engineering University and the Finnish partners were University of Oulu, Finnish College for SMEBA and Wasala Ltd, The project was financed by PHARE/TACIS (200,000 Euro) and co-financed by participating institutions (60,000 Euro). The main target of the project was to improve and expand regional research and development functions in the field of high technology. The common goals were to create an organization that could help (1) to restructure, expand and improve the research and development functions in the field of high-technology; (2) train high technology experts etc. in business.

- TWINNIC-Russian-Finnish Business Twin Incubator for technology oriented SME´s. The partners of the project were: on the Russian side – City of St. Petersburg, and St. Petersburg Regional Foundation for Scientific and Technological Development and the Finnish partners were the City of Lappenranta and BIC Kymi. PHARE/TACIS financing was 179,540 Euros, co-financing constituted 64,681 Euros, totaling 244,221 Euros. The project was aimed at training a team of international entrepreneurs in Russia and Finland in close cooperation with local authorities. Training included 6 months of common lectures and 6 months of on-site training for 10 Russian and 10 Finnish new entrepreneurs.

The European Bank for Reconstruction and Development (EBRD)

The EBRD established its Russia Small Business Fund (RSBF) in 1994 as a ten-year fund, with a contribution of US$ 150 million from the EBRD and the same amount from donor countries (the G-7 and Switzerland). The dual objectives of the RSBF are to: bring formal financial system resources to micro and small enterprises (SMEs) to meet their financial needs, and to contribute to institution building within the Russian financial sector. At present (as of 10 July 2001), the RSBF operates via six participating banks: Bank Petrovsky, Far Eastern Bank, Investment Bank of Kuban, KMB Bank, NBD and Sberbank in 80 towns and cities across Russia. They have a loan repayment rate of 99%. By providing reliable access to financing for the growing number of SMEs across Russia, the RSBF gives direct support to private sector development. The EBRD believes the program will also have a strong demonstration effect, encouraging other Russian banks to enter this market segment.

British Government

Under a British-Russian government-to-government agreement, the Russian Agency for Small and Medium Enterprise Support (SCAMP) was established in 1992. SCAMP received support from the British "Know-How" Foundation. CCI, the Uralmash joint-stock company, Avtovazbank and other influential institutions became supporters of the Agency. Since 1994, the Agency has supported an EU TACIS project creating a network of regional SME support agencies in Russia. "Know-How" sponsored the renovation of

offices and staff training. Twenty-eight regional agencies were established by mid-1996. We were unable to determine the status of these regional agencies.

US Agency for International Development (USAID)

USAID supported a number of both new and existing incubators in Russia. In general, USAID supports; (1) business training for individual entrepreneurs in marketing and western management practices; (2) on-site client focused business consulting services; (3) the formation of effective and sustainable business associations, trade organizations and business support centers; and (4) access to credit for small private businesses. USAID-assisted businesses have improved their ability to access external financing, as witnessed by the $36.9 million obtained by the client firms of USAID's business support centers through 1999. During 1999, USAID provided a total of $2.5 million in micro loans to 2,718 borrowers. From the inception of the program, USAID has provided a total of $8.4 million in micro-credit loans to 5,822 entrepreneurs. Since 1997, USAID has allocated over $5 million of this total to women, who have comprised 70% of borrowers. Since 1994, it is estimated that 597,505 Russian entrepreneurs received business training and consulting assistance through USAID programs.

Other Activities

- The Service Corps of Retired Executives (SCORE) Association is a national, nonprofit organization with 11,500 volunteer members and 389 chapters throughout the United States and its territories. SCORE provides small business mentoring and advice on the full range of business topics. SCORE is a resource partner with the US Small Business Administration. SCORE representatives can be found in local US communities and are available for personal meetings and e-mail counseling. SCORE executives do not typically travel outside the US to work on international projects.
- The International Executives Service Corps (IESC) is a private, voluntary, nonprofit organization. Its mission is to contribute to global stability by assisting in the development of free market economies and democratic societies. IESC volunteers provide expertise to strengthen private sector enterprises and government entities. Their objectives are to promote self-sustainability and greater integration into the worldwide economy. While IESC volunteers are working in some USAID and other government programs, the organization does not have its own initiative in Russia.
- A number of incubators affiliated with US universities have supported projects in Russia. Rensselaer Polytechnic Institute and University of Texas (Austin) custom-designed business management courses for incubator personnel at Russian institutes.
- The TELCOT Institute is an information and telecommunications high-technology incubator based at California State Hayward. Part of TELCOT's focus is to identify high-technology commercialization opportunities with Russian scientists. The Institute acts as a type of virtual incubator with Russian companies and has several commercial projects between western partners and Russian scientists either under contract or in negotiation.

- Boeing in 1992 established a design center in Moscow to work on Boeing projects with 10 scientists. The center has grown to include 650 engineers, scientists and computer specialists from Russia's biggest aircraft design bureaus. Boeing has also placed $5 million in a venture capital fund managed by MINT Capital, a Moscow based venture capital fund, to invest in promising high-technology start-ups. MINT started investing in January 2001 and its target industries are telecommunications, high-technology and media. It has raised $20 million to date. MINT will work with Boeing to identify promising technologies that meet Boeing's needs and standards.[43] (There have been similar examples in the US. In 1999, Panasonic opened a 20,000 sq.ft. incubator in Cupertino , CA which planned to house 15-20 start-up companies that would be supported by a $50 million venture capital fund. Lucent Technologies created a $100 million high-technology venture fund, as did MCI WorldCom but at the $500 million level.[44])
- Since 1992, the USAID, EBRD and a number of Russian institutions have supported the Morozov Project (Morozovskii Proekt), which was established by the Plekhanov Russian Economic Academy and Inkombank. The Russian Academy of Management and Market acts as the main executive body. The achievements of Morozov Project are claimed to be:
- 48 business training centres have been established in many regions of Russia. All of these are based at the leading educational centers, which received Project certification.
- 14 business training centres have been supplied with additional equipment.
- 37 training courses (Small Business Development; Entrepreneurial Law; Entrepreneurial Psychology; Corporate Management, *etc.*) have been developed.
- 2,100 teachers and consultants, as well as 700 officials have been retrained in Russia and in the US.
- 50,000 SME representatives have studied business training services.
- 25,000 clients were provided consulting services.
- 38,000 new job opportunities were developed as a result of the business training centres.
- 66 of the most advanced of the Morozov Project's regional centres have started to develop networks of their own in regional cities (Ekaterinburg, Samara, Petrozavodsk). In all, 150,000 entrepreneurs and employees were trained in the small enterprise sector.
- An EBRD/TACIS funded project: "CIS: Training of Technopark Managers and Trainers" 1993-1995 (approx. 900,000 ECU) was established with the primary goal to train management teams at four Russian technoparks. Training was to address how to create a supportive environment for innovation for small businesses. However, in addition, the project contained a significant element of direct training for innovation entrepreneurs and also involved assisting Russian SMEs in transferring technology to European markets.

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[43] "Boeing's Russian Edge". New York Times. May 26, 2001.

[44] Regalado, Antonio. "Network the Valley! Panasonic creates a nursery for fresh ideas". Technology Review. May/June 1999, pg 24-30.

- As a follow-on project from 1995-1997, EBRD/TACIS funded: "CIS: Training of Technopark Managers and Trainers - Phase II" (approx. 800,000 ECU). During this second phase, an additional four technoparks were assisted and two additional goals were achieved:

    1. The development of four modules of Russian language entrepreneurial training based on the most effective training material developed over the two phases of the program. This material was then successfully transferred to the Russian organization International Business Technology Incubator (IBTI) for further use in training innovation entrepreneurs.

    2. The development of a methodology to identify potentially transferable technology from Russia to the West to reduce the current high failure rate of these types of projects. This information was transferred as part of the training provided to technopark management teams.

- The "Know How" Foundation/TACIS BISTRO project: "Assistance to Russian Technoparks" was funded from 1996 - 1998 with approx. 250,000 ECU. Unlike the previous two projects, which sought to develop the management teams of four of the most advanced technoparks in Russia, this project targeted projects still in the inception or planning stage. The objective was to assist teams and managers to develop their ideas, strategies and plans to open effective technoparks in the Russian context. Six projects were assisted of which four have been launched and are reported to be performing well. In addition, the project's contractor worked with many Russian agencies to help relevant Russian structures develop and improve their support to technoparks.

US Programs in Russia Specifically Aimed at Working with Russian Weapons Technologists

The United States Department of Energy (DOE) and Department of State (State) are the two primary agencies with programs specifically aimed at the problem of brain drain from Russian nuclear, chemical and biological weapons institutes. Each of the programs has a slightly different focus, but all have had mixed results.

DOE's Initiatives for Proliferation Prevention (IPP) program was established in 1994 and to date has received approximately $100 million from Congress. It was established to provide meaningful, sustainable, non-weapons related work for former Russian weapons of mass destruction scientists, through developing commercially viable market opportunities. It works with nuclear, chemical and biological institutes throughout Russia. The program is implemented through research and development projects that have been identified as having commercial potential. The US Industry Coalition was established in conjunction with IPP to help attract investment by US companies in the projects with Russian institutes. The goal of projects is for them to into self-sustaining business ventures that provide long-term employment opportunities for Russian scientists in the high-technology marketplace. Thrust I projects are carried out between US laboratories and Russian institutes. Thrust II projects are industry cost-shared (for $1

from DOE, the private company contributes $2 in cash or "in-kind" work.)[45]. Recently, Credit Suisse First Boston agreed to provide $20 million in funding for a project at VNIITF (Snezhinsk) developing a down-hole radar system for oil and gas drilling. While IPP has had success in employing scientists on projects, the commercialization stage of the program has been extremely challenging because of: lack of capital, lack of a clearly defined goals for achieving commercial success, inadequate training of scientists in business-related skills, limited markets, and concerns about intellectual property rights[46]. Additionally, the instability of the Russian free-market environment exacerbates these factors. According to a GAO Report, DOE directors do not have the experience to train the scientists in business skills and directors in Russia remarked that there is a need for "a cadre of managers (to be trained) who know how to deal in a free market economy."[47]

The other DOE program, the Nuclear Cities Initiative (NCI), is aimed at helping the Russian government in the transformation and "rightsizing" of the Russian nuclear weapons complex to reduce economic pressures that could lead to the diversion of scientific talent to countries of proliferation concern. Three initial closed cities were selected for the project: Sarov, Snezhinsk and Zheleznogorsk. NCI seeks to create new jobs by:

- sharing its experience in downsizing the US nuclear weapons production complex;
- facilitating the selection of promising commercial projects that will lead to employment opportunities for workers;
- developing entrepreneurial skills for displaced workers;
- facilitating the search for potential investors, market analysis, and marketing for products and services; and
- facilitating access to existing investment mechanisms, including investment funds[48]

While IPP focuses primarily on specific projects that have commercialization potential, NCI is primarily focused on job creation and training. According to a recently released GAO report, NCI's main impediments to success include weak economic conditions in Russia; remote locations and the restricted status of the nuclear cities; lack of an entrepreneurial culture among the weapons scientists; and the inadequacy of NCI's project selection process.[49]

The International Science and Technology Center in Russia (ISTC) is a multilateral organization established in 1992 to provide opportunities for nuclear, chemical and biological weapons scientists and engineers to redirect their talents to peaceful activities; the US Department of State represents the US interests. The ISTC employs Russian

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[45] United States General Accounting Office. "Nuclear Nonproliferation: Concerns with DOE's Efforts to Reduce the Risks Posed by Russia's Unemployed Weapons Scientists". February 1999. Pg 2.

[46] Ibid, 38.

[47] Ibid, 39.

[48] United States' General Accounting Office. "Nuclear Nonproliferation: DOE's Efforts to Assist Weapons Scientists in Russia's Nuclear Cities Face Challenges". Washington D.C.; May 2001. Pg 5.

[49] Ibid, 23.

weapons scientists on a contractual basis for research and development and pays the scientists directly. Recently, the ISTC has been the target of criticism because of the lack of commercial orientation of the projects it funds and the concern that ISTC grants are helping to maintain a subsidy mentality amongst Russian weapons scientists. To address this, additional emphasis is being placed on helping scientists identify and develop the commercial potential of their research, providing some business training, and helping fund patent applications[50]. The ISTC established an Industry Partner Program that provides opportunities for private industry, scientific institutions and other governmental or non-governmental organizations to fund research at Russian institutes utilizing the ISTC's infrastructure. This infrastructure allows the partnering institution to make direct, tax-free payments to scientists and to have access to closed facilities on an expedited basis. Limitations to the success of the ISTC's projects include contractual agreement constraints and monitoring and auditing processes.[51]

There tends to be limited coordination between the US government programs that support broad commercialization goals in Russia and those trying to develop commercial opportunities for Russian weapons technologists.

[50] Ibid, 3.
[51] Ibid, 20.

Appendix D.

Study Methodology, Organizations Visited & Visit Schedules

How we conducted the study

We began this study in early May by sending a written questionnaire to all of the Russian participants who attended the Sam Nunn Policy Forum in March 2001, and conducted a series of conference calls to many of the American participants who have been actively working with scientists from the closed nuclear cities and chem-bio institutes. Our focus was to identify the respondents' views on the factors inhibiting the formation of high-tech small and medium enterprises (SMEs) in Russia today, with special emphasis on the closed cities and chem-bio institutes. We received many thoughtful responses from both Russian and American sources, which helped to shape our initial hypotheses about the role of incubation in SME formation, as well as identify numerous challenges and obstacles to further study.

Based in part on these results, we next established a schedule of meetings with a variety of Russian Federation ministries, institutes, think tanks, NGOs, investment bankers, venture capitalists, law firms, and accounting firms for the first of our two two-week visits to Russia. Our first trip, June 9-22, was limited to the Moscow area, to maximize the number of appointments we could schedule.

During the two weeks after our return, we conducted further conference calls with both Russian and American sources, reviewed our voluminous meeting notes, revised our hypotheses, and arranged a schedule for our second trip. Our second trip, July 7-20, included visits to chem-bio facilities in Novosibirsk/Koltsovo, Serpukov and Obalensk, as well as many new meetings in Moscow. Despite our request to visit the closed nuclear city of Sarov, which had been submitted 90 days in advance to Minatom, we did not receive visit clearance, and had to arrange for representatives from Sarov to travel to Moscow for discussions.

Upon our return from the second visit to Russia, we reviewed further meeting notes, analyzed cost and other data on doing business in Russia that had been provided by numerous sources, and drafted our report to NTI.

Schedules of our trips, trip notes, and materials given to us by participants are being provided to NTI separately.

Who we are

Our team consisted of five members, all affiliated with the Georgia Institute of Technology, but operating as independent consultants for the conduct of this study. They included: Dr. William Hoehn, Project Leader; Ms. Robin Solomon, Deputy Project Leader; Mr. Chris Downing; Ms. Marina Alexeenko; and Ms. Andrea Littman. Dr. William Hoehn is an economist by training, and has served as a researcher and vice president of the RAND Corporation, as well as in the Pentagon and as a Senate staffer to

former Senator Sam Nunn. Ms. Robin Solomon has a degree in business, and spent seven years in Russia, in private business and as the director of the US Department of Energy's Moscow Office. Mr. Chris Downing is the Deputy Director of the Advanced Technology Development Center, Georgia Tech's high-tech business incubator. Ms. Marina Alexeenko is a graduate student at Georgia Tech, majoring in business administration, who also served intermittently as an interpreter for our group. Marina is from Biysk, Russia and worked on a number of TACIS programs related to small business and enterprise support in Russia's regions. Ms. Andrea Littman is also a graduate student at Georgia Tech, majoring in international affairs. She has focused her research efforts over the years on the Russian chemical and biological weapons institutes.

We employed two sets of consultants in Moscow:

- The Center for Research and Statistics is a nonprofit foundation affiliated with the Russian Ministry of Industry, Science and Technology. The Center has published numerous studies on technology innovation in Russia and the Russian scientific community. Dr. Leonid Gokhberg, the Center's Deputy Director, and his staff prepared several important papers addressing specific topics on intellectual property rights, science towns, incentives for innovation, and innovation related organizations.
- The Technology Development Company, LTD. (TTDC) provided the services of Elena Stepina from their Moscow office. Before joining TTDC, she was the Deputy Financial Director at the ISTC. She has extensive contacts in the Novosibirsk community and she coordinated our trip with officials from Vector. Ms. Stepina joined our trip to Novosibirsk and her insights into local dynamics were very helpful. For our Moscow visits, Tony Gilbreath worked with our team and assisted in scheduling some Moscow appointments. Both Ms. Stepina and Mr. Gilbreath provided written summaries from our meetings.

Our study and report would not have been possible without help from the following individuals and organizations:

- Randy Beatty, Maria Douglass and Irina Roslova from the International Science and Technology Center, who helped arrange a number of our meetings in June and made excellent recommendations. They also made the arrangements for us to visit the closed site of Obalensk.
- Lev Sandakchiev, General Director of Vector, as well as Vladimir Ryabenko and Vladimir Kulichkov (from Vector), for their work developing our schedule and arranging all our meetings in Novosibirsk.
- Dan Wolfe, formerly with Troika Dialog in Moscow and now an independent consultant in the US. He helped provide introductions to a number of the financial organizations we met with.

Summary of the organizations we met with and experts we spoke with

We held discussions or met in person with individuals from the following organizations that are in either directly or indirectly supporting high-technology commercialization in Russia.

US government initiatives:

- Nuclear Cities Initiative
- Initiatives for Proliferation Prevention/US Industry Coalition

Multilateral initiatives:
- European Bank for Reconstruction and Development
- International Science and Technology Center
- The US-Russian Investment Fund
- TACIS: Project Finrus 9804 "Innovation Centers and Scientific Cities"

Nongovernmental organizations:
- Eurasia Foundation
- American Chamber of Commerce
- Foundation for Applied Scientific Research
- Alliance of American and Russian Women
- High Technology Foundation/Gorbachev Project
- PIR Center

Russian government organizations:
- Duma Committee on Economic Policy and Private Enterprise
- Federation Council, Information and Analytical Directorate
- Regional and local governments
- Agency for Small and Medium Enterprise Development
- Fund for Assistance to Small Innovative Enterprises – Bortnik
- Centre for Science Research and Statistics (at the Ministry of Industry, Science and Technology)
- National Association of Business Incubators
- Russian Government Federal Fund for Small Business Support

Russian Ministries:
- Ministry of Atomic Energy
- Ministry of Agriculture
- Agency for Munitions
- Ministry of Industry, Science and Technology, Department for the Innovation and Commercialization of Technologies

Technoparks we met with:
- Kurchatov Institute
- Krasnaya Zvezda – Minatom's Technopark
- MEPHI – Moscow State Engineering Physics Institute
- Moscow Power and Engineering Institute
- Technoconsult
- Moscow State University
- Novosibirsk Technopark

- Koltsovo Innovation Center

Universities and Research Institutes:

- Moscow Institute of Physics and Technology
- Moscow State University, Chemistry Department
- Institute of Toxicology and Hygienic Regulation of Biopreparations, Serpukhov,
- State Research Center for Applied Microbiology, Obalensk
- State Research Center of Virology and Biotechnology "Vector", Novosibirsk
- Budker Institute of Nuclear Physics, Novosibirsk
- Boreskov Institute of Catalysis, Novosibirsk
- Novosibirsk State Technical University

Financial institutions:

- Credit Suisse First Boston
- Baring Vostok Capital Equity Partners
- Orion Capital
- Troika Dialog
- United Financial Group
- Delta Leasing
- Women's Microfinance Network

Private companies investing in Russian high-technology sector:

- The Technology Development Company
- PHLburg Technologies
- Russia Partners
- Innovative Ventures
- Ixcellerator
- Mikhailov and Partners

Service providers/consulting companies:

- Squire, Sanders Legal Counsel
- Price Waterhouse Coopers
- Ernst &Young

In the course of conducting our study, we spoke with the following individuals recognized as leaders in the US community for their work with Russian nuclear, chemical and biological weapons scientists, specifically to identify new sustainable economic job alternatives:

- Sig Hecker and Mark Mullen, Los Alamos

- Bill Potter, Adam Stulberg, John Leppingwell, Monterey Institute
- Ken Luongo, Bill Hoehn, and Raphael Della Ratta, Russian-American Nuclear Security Advisory Council (RANSAC)
- Kristen Suokko, W Alton Jones
- Ray Smilor, Foundation for Enterprise Development
- Bill Dunlop, Ron Lehman and Eileen Vergino, Lawrence Livermore National Laboratory
- Vic Alessi and Gary Tidings, United States Industry Coalition
- Bill Desmond, Nuclear Cities Initiative
- Glenn Schweitzer, National Academy of Sciences
- Igor Khripunov and Mike Beck, University of Georgia
- Jonathan Ricmond, Centers for Disease Control
- Rose Gottemoeller, Carnegie Endowment for International Peace
- Second Chance Foundation

Other individuals/organizations were identified in the course of our research that we believe would be interested in an incubator project and might be able to make a constructive contribution:

- MacArthur Foundation
- David Speedie, Carnegie Corporation
- Dave Huber, Milcom Technologies
- Cliff Gaddy, Brookings
- David Bernstein, Stanford University
- George Gamota, Science and Technology Management Associates
- Phil Petersen, Institute for Applied Science
- Paul Walker, Global Green

The labyrinth of organizations in Russia trying to encourage the development of small and medium enterprises is daunting. Even more daunting is the fact that the efforts are largely uncoordinated and most organizations are targeting only one aspect of this complex problem. Nowhere is there to be found an integrated plan to deal with the full range of problems and disincentives to SME formation in Russia.

We made every effort to uncover and meet with as many of the central players involved as possible in supporting innovation in Russia, particularly in the high-technology sector. In almost every meeting we attended, recommendations were made for other individuals or organizations to contact. We are sure with further digging additional Russian government entities and non-governmental organizations would come to light that to a lesser degree may be involved in the process of promoting commercial high-technology development among Russian scientists. An independent organization that could help strengthen the communication and coordination between the multiple parties involved in high-technology commercialization could be very helpful. Simply providing a mechanism in Moscow to serve as an informational resource on all the organizations and activities supporting high-technology innovation in Russia would improve efficiency and increase potential leveraging opportunities.