CHAPTER 7

DEFENSE CONVERSION: HOW FAR CAN RUSSIA EXPAND SMALL AND MEDIUM ENTERPRISES?

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While numerous barriers have hampered the growth of the small and medium enterprise (SME) sector in Russia, this sector has the potential to help curb proliferation of strategic weapons and technology from Russia. The long-term development of a more significant SME sector in Russia would help provide alternative employment opportunities, reduce excess military-oriented research and development (R&D) capacity, increase nonweapon export revenues, and encourage broader economic reforms and nondefense enterprise growth. These potential contributions are particularly important, given the continuing Russian government focus on large defense enterprises, the weak record of new job creation in Russia, and the failure of defense industry conversion efforts. This chapter considers the major barriers to SME growth, examines factors supporting such growth, and offers a range of suggestions for how Western policies can help the Russian SME sector develop so as to play a positive role in reducing strategic weapons proliferation from Russia. In the U.S. approach to such barriers, of course, care must be taken to avoid dismantling those that, while discouraging Russian SME growth, also discourage proliferation activities.

After a period of rapid growth in the early 1990s, the Russian SME sector has stalled and is less than one-fifth the size of comparable SME sectors in other advanced economies. The most powerful barriers include:

- Institutional and administrative burdens (excessive tax, bureaucratic corruption, regulatory burdens, lack of effective government support or unemployment safety net);

- Resource and demand constraints (inadequate access to start-up capital or other financing, low investment, barriers to market entry that favor large incumbent businesses, depressed domestic demand, unequal market competition);

- Personal and societal views (negative views of entrepreneurs, resentment, risk-averse technologists, passivity, preference for large-scale/high-end projects, fear of uncertainty);

- Managerial approaches (focus on old bureaucratic methods, focus on state support, lack of effective new ownership, low turnover, lack of skills to identify markets); and,

- Structure of defense R&D in Russia (labor-intensive, lack of integration, state support and hidden subsidies for large enterprises, lagging technology development, lack of marketability).

Nevertheless, there are some positive factors that may be exploited to promote SME sector growth, particularly in market niches such as information technology, offshore programming services, medical equipment, and consulting where there is access to foreign markets and funding.

There are lessons from past cases and experiences in other transition economies to help guide Western policies and assistance programs in more effectively encouraging the emergence of a larger Russian SME sector, thus helping discourage proliferation:

- Emphasize market-driven commercialization and focused business services; recognize that many market areas tend to be medium-tech instead of high-tech, and that the early involvement of Western private sector partners can be critical;

- Establish clear program goals and evaluation guidelines; avoid projects and enterprises that do not meet initial viability criteria;

- Focus support on local and regional programs that have proven most effective (a number of regions in Russia have demonstrated effective SME growth using local programs); and,

- Reduce the emphasis on short-term assistance to employees at incumbent or state enterprises (encouraging personnel to leave those incumbent enterprises will be critical in achieving long-term SME sector growth and reducing excessive focus on continuing military work).

Introduction.

This chapter investigates how efforts to encourage entrepreneurial activity in Russia's defense scientific and production sector could serve as part of a long-term strategy to reduce the proliferation of strategic weapons and technology from Russia. In particular, I look at the potential for expanding the SME sector in Russia, and consider the impacts this may have on Russian proliferation behavior. While entrepreneurial activity is broader than the SME sector, the growth and status of SMEs are critical indicators of the activities of entrepreneurs in creating new jobs and innovative technology in many transition and advanced economies, and can serve as a good measure of the scale of entrepreneurial activities in the Russian economy.

The proliferation of strategic weapons and technology from Russia is driven by many factors that are not affected by the SME sector, but growth in the SME sector can have

significant impacts on both the capabilities and the incentives for individuals and enterprises to proliferate weapons and technology.[1] Given the strong Russian government focus on large enterprises as the core of Russian defense industry, as well as the weak job creation in the Russian economy and the failure of efforts to convert or restructure Russia's defense industry towards civilian applications, it would appear that an expansion of the SME sector may help reduce Russian proliferation by the following means:[2]

- Providing alternative employment opportunities for defense sector technical specialists and other personnel;

- Reducing excess military-oriented industrial and scientific capabilities;

- Increasing Russia's ability to earn revenues through activities other than exporting raw materials or military capabilities;

- Encouraging stronger economic reforms and enterprise growth in areas not related to the military; and,

- Reducing the influence of the defense sector in government policymaking.

However, it is important to recognize that some types of expanded SME activities may dismantle existing barriers to proliferation and brain drain, thus harming nonproliferation efforts.

While the small business sector has been a significant source of innovation and new job creation in many successful transition and advanced economies, this sector is simply too small to play a comparable role in Russia unless major steps are taken to expand it. The Russian SME sector remains much smaller than those in many other transition economies or Western countries. For example, the share of gross domestic product (GDP) produced by the SME sector is 5-6 times larger in mature

market economies than in Russia.[3] The successful transition economies of Poland, Hungary, and the Czech Republic also have much more significant SME sectors than Russia, with over one million SMEs in Poland, and 500-700 thousand in Hungary and the Czech Republic. The relatively small size of the Russian SME sector is shown in Table 1 (based on 1997 data). In addition to being undersized, the Russian SME sector is very geographically concentrated. About a third of all Russian SMEs are located in just Moscow and St. Petersburg alone.

Country	Number of SMEs (thousands)	Number of SMEs per 1,000 Population	Employment by SMEs (millions)	Percentage of Total Employment	SME Share of GDP (Percentage)
Japan	6,450	49.6	39.5	78	52-55
EU	15,770	45	68	72	63-67
U.S.	19,300	74.2	70.2	54	50-52
Russia	844	3.6 - 5.7	8.3	13	10-11

Table 1. Relative Size of SME Sectors.[4]

The SME sector did not exist at all in the Soviet period. All enterprises were entirely state-owned, and the concept of private business was not accepted until the economic and legal reforms of the late 1980s.[5] While the SME sector in Russia grew rapidly after private enterprises were legalized in 1990-91, growth of this sector stalled in Russia after 1994, with the decline in the number of people employed by small firms reflecting a worsening climate for such firms.[6] In fact, the number of small businesses in Russia that specialize in R&D reportedly fell by 60 percent in the period 1994-97. The proportion of small businesses specializing in R&D fell from 8.2 percent of all SME in 1994, to 5.1 percent in 1997.[7] While trade and service sectors in Russia have seen the emergence of widespread SME activity, small businesses have not played a significant role in the R&D, technology-intensive, or defense-related areas.

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Number of Firms (thousands)	268	550	875	896	877	842	861	868	890
Number of Full-time Employees (thousands)				8,480	8,995	6,269	6,515	6,208	6,292
Number of Part-time Employees (thousands)				6,677	4,926	2,352	2,124	1,194	970

Table 2. Russian SME Sector Employment, 1991-98.[8]

BARRIERS TO ENTREPRENEURIAL ACTIVITY IN THE DEFENSE SECTOR

An enormous number of barriers have limited the growth of entrepreneurial activity and the SME sector in Russia, and many of these limiting forces are particularly strong in defense-related sectors. These factors have contributed to the current situation where large businesses and institutes continue to dominate the defense sector, while the existing SME sector remains too small to play a significant role in creating new jobs. In fact, many conditions for SMEs worsened during the 1990s, and continue to be problematic today.

Institutional and Administrative Constraints.

Factors such as excessive tax, bureaucratic corruption, regulatory burdens, lack of government programs to promote SMEs, lack of adequate intellectual property rights (IPR) protection, and lack of an effective unemployment safety net have severely hampered the development of entrepreneurial activities and the SME sector in Russia.[9] These factors have combined to distort the emerging Russian market and hinder the emergence of entrepreneurial small business. There are literally hundreds of state bodies involved in oversight and regulation of SMEs at all levels of the economy.[10] For

example, inadequate protection of IPRs has led to a situation where an estimated 90 percent of the software applications used in Russia are pirated (vs. under 30 percent in the United States), thereby significantly limiting the ability of the new software industry to develop profitable domestic markets in Russia.[11] The fact that Russian state institutions often have partial patent rights over the work of their personnel further complicates the IPR situation for prospective private enterprises.

The tax system disadvantages small firms due to the onerous compliance burden (maintaining records, declarations, dealing with multiple tax organizations) and excessive rates. Administrative barriers include the numerous registration, licensing, and reporting procedures imposed on small businesses by multiple levels of authorities and administrative bodies. The need to obtain licenses and administrative permissions from numerous bureaucratic offices provides fertile ground for corruption. In addition, surveys report that 75-80 percent of SME managers complain of being subjected to threats and coercion from criminal groups. Many large enterprises continue to play significant welfare support roles, meaning that the large ministries, scientific research institutes, and producers have an advantage over smaller enterprises in providing social benefits such as housing, access to health care facilities, etc.[12]

Russian government support programs and IPR protections for SMEs are ineffective. While many Russian and international studies have pointed to the problems caused by the numerous administrative barriers to SMEs and while many Russian government programs and regulations have declared support for dismantling these barriers, it appears that these problems have, in fact, worsened during the past decade. There is a widespread perception that while some tax incentives for SMEs were instituted in 1990-95, the Russian central and regional governments have not taken enough action to build a support framework or provide funding sources for small

businesses or R&D activities since the mid-1990s. As happens all too often in Russia, the laws passed in support of SMEs have not been implemented, and many government initiatives have not been adequately funded.

In addition, Western assistance programs that seek to address proliferation concerns have primarily focused on large state organizations, thus encouraging scientists and specialists to retain their ties with these organizations. Many of the plans being developed to revive the Russian R&D sector or overall economy itself still focus on the largest enterprises and top-down approaches. The Russian government and many industry analysts have discussed converting the military-industrial complex into a scientific-industrial complex, but they still focus on doing this by reviving the largest enterprises and funding new large conglomerates, not by focusing on the needs of SMEs.[13]

Resource Constraints.

The inability to access sufficient financial resources to support and expand new businesses has hampered the Russian SME sector. These barriers include insufficient banking and financing sources, low levels of investment, and the practice of banks providing funds based on personal connections or a preference for funding export operations.[14] The poor investment climate in Russia has discouraged foreign direct investment (FDI), which has been valued at under 1 percent of Russian GDP, compared to over 7 percent in Poland and even higher in other advancing economies.

Even Western programs to provide loans have not focused on technology start-ups, and often disburse most of their funds to businesses in the service and retail trading sector. For example, U.S. funding provided to the European Bank for Reconstruction and Development's Russia Small Business Fund (as part of the U.S. Nuclear Cities Initiative) has been disbursed largely to the trading sector, where most loan recipients do not have employees linked to scientists.[15]

The domestic Russian banking sector is not well developed and has been reluctant to invest in the military sector outside the largest export-supported enterprises. Thus, SMEs lack access to adequate start-up capital, and are often forced instead to rely on personal resources, family, friends, and criminal structures.

Demand Constraints.

Many Russian SMEs have a hard time finding markets for their goods and services because they face dominating state and large businesses, foreign competition in higher-technology areas, and overall depressed domestic demand.[16] SMEs face significant barriers to entry in many market areas due to hidden subsidies, administrative measures, and distorted prices that all favor large existing businesses. Russia still has far to go to develop a competitive market economy, and there are distortions in much economic activity that limit the ability of entrepreneurs and SMEs to find domestic markets. In addition to the depressed demand, the lack of information about market demand has led to waves of excess competition as multiple enterprises seek to produce similar products, ignorant of the others' activities.[17]

Barriers to entry created by numerous hidden subsidies, administrative measures, and distorted prices that still support large state-owned, or former state enterprises, make it difficult to start up new private firms even if they are more productive than the existing firms.[18] Market distortions that stem from efforts to address social concerns, corrupt practices, and the lack of information continue to raise barriers to SME and prevent equal competition. A 1999 McKinsey report argues that the unequal market competition conditions "tend to favor low productivity incumbents, protecting them from takeovers and productive new entrants."[19]

Personal and Societal Views.

There are deep-seated personal views and beliefs pervasive in Russian society that have limited the growth of entrepreneurial activity and SME business activities, particularly in the defense-related sector. At the personal level, many scientists and defense technologists who could start up SMEs tend to be risk-averse, older, and ill-adapted as entrepreneurs.[20] These potential entrepreneurs often display such attributes as passivity, a reluctance to stand out from the herd, fear of job instability in new small companies, and a preference for more "interesting" high-tech R&D instead of commercial projects. The history of failure when individuals in the military-industrial or R&D sector seek to start new enterprises without having high-level connections has also added to personal reluctance to leave the relative stability of large or state-funded organizations to undertake new entrepreneurial ventures. Even some entrepreneurs, who have set up relatively well-paid teams of Russian computer programmers to provide outsourcing support for U.S. and other Western companies, report that they have difficulty finding Russian programmers who want to work on these projects because they view them as less interesting and less challenging work than their military-related or scientific work.[21] In addition, many would-be entrepreneurs have a pronounced preference for large projects, often seeking to start with expensive large-scale projects instead of the smaller, incremental approach favored in the West.[22]

At the societal level, public opinion polls reflect an uncertain and ambivalent attitude towards "entrepreneurs," who are often seen as shady and dishonest, and sometimes resented for their apparent wealth. Surveys report common resentment of private wealth and private business, and negative attitudes towards entrepreneurs and spin-offs from state organizations.[23]

While the passivity of many Russians in terms of accepting the conditions within which they live and not

acting to take control to change those conditions may hamper the development of entrepreneurial activities, such passivity can also serve to restrict some types of proliferation activity. For example, surveys of specialists working in key Russian nuclear and missile facilities in some of Russia's closed cities have found that a basic passivity has helped keep these specialists from acting to go abroad or sell their skills to foreign customers.[24]

Managerial Approaches.

Many managers in the military-industrial sector have been conditioned to be risk-averse, conservative, focused on maintaining large payrolls, and wed to using old methods, cronyism, and appeals for state support instead of restructuring their enterprises or moving away from reliance on government orders. Privatization of industry has not led to effective control by new owners who would promote market-oriented entrepreneurial approaches, and the defense R&D sector is much less privatized than the production sector.[25] Instead, enterprise managers have gained increased power to push for state support, but have not become accountable to profit-driven imperatives or outside owners. There has been low turnover in management. By one estimate, as little as a 5 percent change per year has occurred in enterprise management.[26]

Military-industry managers have been conditioned to be risk-averse, conservative, and tolerant of bloated payrolls. They are skilled at bureaucratic infighting, and most are not inclined to be entrepreneurs. These traits persist today for many managers.[27] Their tendency has been to build bigger groups (financial-industrial groups, holdings, etc.) rather than to fully pursue independent spin-offs or SMEs. The partial shift in ownership at many enterprises has not led to effective new ownership control, and has allowed the legacy directors to assume greater control in many cases. This has contributed to their becoming less responsive to the state, pursuing instead their own parochial interests. In

addition, many managers continue to believe that state defense orders will revive, so they hold out for the benefits from that eventuality. Recent funding increases under the Putin administration, increased funding from Minatom for nuclear weapons enterprises, and the promises of more to come have worsened this problem. Managers often see commercial work as temporary, and seek short-term projects to help tide them over until government funds arrive.[28]

Most mangers lack the skills and ability to identify market opportunities. For example, the RAN USA and Canada Institute operated several programs with Pepperdine University in the United States to provide business training to over 100 managers from large Russian military-industrial enterprises, but the business plans those managers developed after receiving training were not implemented because they did not identify viable areas of demand in the Russian market.[29]

The defense sector managers are gradually being forced to change their approaches as their environment changes. By the late 1990s, it became apparent from periodic observer visits to Russian military R&D and production facilities that those organizations doing relatively well tend to have the most dynamic and assertive directors, in addition to having access to foreign markets for their goods.[30] The organizations whose directors or senior staff are still focused on the Russian government for support and guidance tend to be doing much poorer, but have still managed to survive, often as shells to provide some basic support for their personnel. Nevertheless, government support policies through the mid-to-late 1990s, for example, providing credits to help military-industrial enterprises in the worst shape, encouraged a continuation of sluggish managerial behavior. Whereas managerial behavior bent upon exploiting the old system worked relatively well in the early 1990s, it appears that the macroeconomic situation and market then became "more rewarding to qualified enterprise management" such that the quality of

management has now become more important in supporting enterprise success than it was earlier.[31]

Structure of Defense R&D Sector.

Despite hopes that the massive Soviet defense R&D sector would serve as a powerful source of innovation and technology capabilities to power a new high-tech industrial sector in Russia, efforts to convert this sector have largely failed. Overall, the Russian defense R&D sector has lost much of its technological competitiveness, as the lack of funding for R&D over the past decade, in addition to the relative inactivity of high-tech companies and SMEs, has taken its toll.

The R&D sector suffers from many of the same problems as those afflicting overall military industry, and faces many of the Soviet legacies such as excessive size, labor-intensive approach to research, extreme centralization, and geographic concentration.[32] The defense R&D sector accounted for 70-80 percent of all Scientific Research Institute (NII) and R&D work, covering about one million personnel working in the science-related area at the start of the 1990s.[33] The Soviet approach led to separation of research, development, and production in separate organizational entities (NII, Design Bureaus [KB], Scientific Associations [NPO], Production Associations [PO]), and the breakdown of strict centralized Soviet controls has made this lack of integrated R&D chains particularly troublesome. While production associations and enterprises had a high degree of vertical integration in terms of production inputs, the clear separation of research facilities from the production sphere has hampered the sector's ability to move new innovations to the production stage. Moreover, it is very difficult to get a good picture of innovation in the defense R&D sector because official statistics leave many issues untouched. Much of the innovative activity has occurred in the unofficial areas of the economy.[34]

The Russian military-industrial sector continues to be dominated by large enterprises, and small businesses have played a negligible role in defense research, design, development, and production. Indeed, the Russian military-industrial sector retains many of the characteristics that encouraged large enterprises, e.g., the advantage of size in giving enterprises influence, pressure for self-sufficiency in material inputs.[35] The Soviet-era orientation towards very large enterprises continues in the military-related scientific-research community, the production community, and others. A 1997 study found that large defense sector enterprises employing over 5,000 people performed better and were more successful in retaining their core capabilities than smaller firms.[36] More recent studies of the situation after the 1998 crisis found that mid-sized companies (500 to 2,000 employees) did well, but that small enterprises did worse in both surveys.[37] Directors of R&D organizations found that their position in the system was improved as their organizations grew solely in terms of numbers of employees or size of budgets, while profit margins were not even known, let alone considered. The artificial pricing system used through the early 1990s and the continuing system of hidden state subsidies have hindered the ability of the military-industrial sector to adjust in the transition to a market economy by making it almost impossible to calculate market values for inputs or products in much of the sector.

Many analysts argue that Russian fundamental research is of high quality, but that Russian capabilities are weak in applied R&D oriented towards creating civilian products with commercial potential. Most Russian technology is not internationally competitive, and Russia has a history of conducting R&D with little attention to cost or marketability considerations.

Russian technical experts do not have experience in market-driven R&D. Indeed, the vast majority of R&D personnel today still seek to sell technology-push capabilities-driven projects, instead of market-pull projects.

They market and propose what they know and have, but these capabilities are usually not what the commercial market wants. Almost any U.S. businessman today who visits Russian R&D facilities will come back with huge numbers of proposals regarding which scientists seek to find funding for their pet projects, regardless of the fact that no market demand conceivably exists.[38] It still remains to be seen how much commercial potential Russian defense technologies have, so Western-supported programs that focus on the commercialization of Russian lab technologies are taking a partial, ultra-cautious approach. This is not the path to a large-scale solution to the problem and is bound to provide only limited results.

In addition, there is a clear Russian government orientation towards large enterprises in the defense sector, with the Russian government giving preference in domestic arms contracts to large Russian firms that sell their weapons systems abroad because it views this ability to sell weapons on the global market as a key indicator of the firms' economic viability.[39] The Putin administration has placed increased emphasis on expanding arms sales as a critical source of revenues to fund military R&D programs, as well as fill state coffers and fund military-industrial enterprises themselves.[40] Current Russian government plans to restructure the defense sector call for merging many enterprises to create 30-40 even larger holding companies that will further expand industrial conglomerates that dominate defense industry.[41]

Security Restrictions.

Restrictive security regulations and pressures on employees who have worked in secure military-industrial facilities hinder the ability of these employees to create new SMEs. Access to international donors, technical exchanges, and travel abroad can all be restricted by the security organs. These restrictions have become stronger in the recent past, with a resurgence of FSB campaigns against

interactions with foreigners—including accusations that joint ventures are Western espionage efforts, and new Russian Academy of Science instructions requiring scientists with access to classified materials to report all contacts with foreign colleagues to the security departments. Even specialists who are no longer employed at military-related facilities have reported being subject to visits from security personnel who seek information and even press for bribes in exchange for noninterference in prospective new business ventures.[42] As with many administrative barriers in Russia, the existence of security regulations often simply serves as a means for bureaucratic officials to extort additional payments from those complying with the regulation.

FACTORS PROMOTING ENTREPRENEURIAL ACTIVITIES

While numerous powerful forces have limited SME and entrepreneurial activities in Russia, the list of factors that encourage such activity is much shorter.

Economic Need.

The basic failure of the government to provide for the economic needs of most military-industrial enterprises has encouraged specialists to look elsewhere for work, and has begun to encourage the enterprises themselves to restructure and undertake more entrepreneurial activities. While a centralized large-scale approach to planning economic programs still dominates in many organizations, the absolute decline in conditions in much of the military-industrial sector serves to promote new approaches, if only out of desperation. It is estimated that the number of employees in military-related R&D organizations, e.g., NII, had fallen by 60-70 percent by the end of the 1990s, and many specialized design teams had fallen apart.[43] In 1992-94 alone, during the first wave of employee departures, overall employment in science fell

over 20 percent.[44] Numerous Russian defense R&D organizations have been hollowed out because many of the most capable, younger, active employees have gone, leaving behind the bureaucratic shells with too many managers and older staff who are often the least entrepreneurial.[45] The average age of workers in the military-industrial sector has risen from 47 years in 1996 to 58 years in 2000.[46]

The lack of government funding, investment, or market profits for the defense sector can encourage new approaches. Total R&D expenditures fell over tenfold in the 1990s, and the share of military R&D in official Russian defense expenditures fell from 18.6 percent in 1990 to 3-4 percent in the late 1990s.[47] This decline in R&D has occurred in the context of the collapse in military output of the Russian defense complex without any corresponding increase in civilian output from the defense complex (see Table 3).[48]

	1992	1993	1994	1995	1996	1997	1998	1999	2000*
Total output	80.4	64.6	39.2	31.2	22.7	19.0	17.6	24.6	31.7
Military output	49.5	32.5	19.9-26.8	16.6-21.4	12.8-17.2	8.8-13.2	9.9-13.9	13.9-19	17.9
Civilian output	99.5	85.6	52.6-46.4	41.3-40.4	29.1-33.5	27.8-32.8	22.6-30.2	39	

* - projected.

Table 3. Relative Military and Civilian Outputs of the Russian Military-Industrial Sector (1991=100).

In part due to the lack of centralized funding and failure of large-scale conversion efforts, many military-industrial enterprises allowed for the creation of internal spin-offs, and some of these have gone on to become viable SMEs working in technology areas. While there was a lot of activity in the early-to-mid 1990s, most enterprise efforts to produce more technology-intensive industrial and consumer goods were not successful—these markets were

dominated by imported goods.[49] The slight increases in overall output of the military-industrial sector in 1999 (Table 3) came as the demand for domestic consumer durables such as refrigerators, washing machines, and televisions rose, and as the foreign competition was priced out of the low-end market in the aftermath of the August 1998 crisis. [50]

While insufficient central funding has encouraged many military-industrial enterprises to seek new approaches, the economic need has been sharpest in sectors of low proliferation concern, such as those producing many basic conventional weapons like tanks, rifles, etc. The industrial sectors of most concern to the West in terms of proliferation potential—the nuclear and missile industries—have been relatively well funded, and are increasingly better funded today.

Work Force Characteristics.

The Russian population is highly educated and technologically innovative. Universities and institutes in Russia have been producing highly skilled engineers, scientists, and other R&D specialists for decades. The numbers and percentages of young people enrolled in technical education fields continue to be among the highest in the world.[51] The early boom in the expansion of the SME sector showed the existence of an entrepreneurial spirit in many Russians, despite the historical record of a state-dominated society, as the flow of active, entreprenurial-minded specialists out of the defense sector provided critical skills to the new economy. Many of the initial SME managers in the early 1990s were technical specialists from the R&D sector, and they have paved the way for others to potentially follow.

Nevertheless, younger specialists are not entering the defense field, and admissions at most military-technical institutes have fallen. Banking and trade have been two of the leading sectors attracting talented young specialists

away from their training at prestigious technical institutes. Young people are not pursuing educational programs that would lead them into the defense R&D or industrial sector. By the mid-1990s, senior officials at prestigious military-technical institutes, R&D associations, and production facilities echoed the common refrain that the "Nike effect" was draining their organizations as the brightest youngsters left to seek their fortunes in the new economy, buying and selling sneakers or other imported consumer goods.[52] Throughout the 1990s, increasing numbers of students at some of the most prestigious institutes, e.g., Bauman, either were leaving their studies early to go work in other areas or were applying their skills in commercial structures instead of for R&D purposes.[53]

Market Niches.

There are relevant market niches where SMEs have begun to play increasingly significant roles, in such sectors as software programming, medical equipment, consulting services, etc. The ability of SMEs to respond flexibly to changing market conditions and quickly enter new business areas gives them certain advantages over the large established enterprises that still dominate most existing market sectors. The information technology (IT) and computer programming sector are examples of a new business area where SMEs have led the way in developing new capabilities, enterprises, and markets. For example, it is estimated that the offshore programming sector in Russia may be able to expand at rates from 20-50 percent per year to meet international demand for such services. This sector currently generates under $100 million in revenues per year in Russia, compared to over $6 billion in India, as part of a global market that is anticipated to grow to over $1 trillion per year by 2008. A 1999 McKinsey study found that productivity in the Russian IT project services sector was 72 percent of the productivity of the comparable sector in the United States, which was the highest productivity level in any of the industry sectors evaluated in the study.[54]

Nevertheless, it is interesting to note that Russian companies working in this area face many of the characteristic barriers to SMEs in Russia, including the reluctance of Russian defense-sector programmers to work on more mundane commercial programming tasks even though the pay is significantly better than for work on military-industrial projects, the hindrances of working within security restrictions, low domestic demand, lack of skilled managers, administrative and regulatory challenges, lack of experienced marketing support, and the lack of Russian government support programs.[55]

There are some military-related technology and industry sectors where Russian capabilities remain highly competitive and where small business activities have become visible. Russian technological capabilities perhaps remain most competitive in areas such as aerospace, materials science, computer science, optics, and sensor technologies. Some of these industry sectors saw small businesses emerge in the defense area during the 1990s to compete on the basis of quality and price—examples can be found in areas such as avionics, navigation, software, radio, and personnel protection.[56]

Access to Foreign Markets and Funding.

A wide range of Western donor organizations, led by the EU TACIS, USAID, and EBRD programs, but more recently including the U.S. IPP, NCI, and other programs, have provided significant assistance for SME development in Russia. In many regions, these international donors have provided more funding for SME support than have Russian government programs. While hundreds of millions of dollars have been provided in funding, technical assistance, loan guarantees, etc., it is difficult to evaluate the impact these programs have had on job creation.[57] There are many programs and support organizations active, but international assistance programs too often are not based on preliminary research or tailored to meet specific needs in

the regions of Russia where they operate. There is continuing uncertainty about the sustainability of many programs started with international funding since most SMEs lack the resources to pay for the training and assistance provided by these programs. Nevertheless, broad programs such as the Morozov Project, Russian Agency for SME Support, Technopark Association, and others have had significant impacts in helping to expand the Russian SME sector. The expanded knowledge of foreign markets and funding sources developed over the past decade has encouraged the creation of SMEs that can obtain funding. Indeed, access to foreign capital or markets is a major indicator of the health of enterprises—regional and national studies have found that most industry leaders have links to international markets or finances.[58] Foreign funding has played a major role in supporting innovative firms in the aerospace, nuclear, and software industries.[59]

Unfortunately, some of the international programs aimed at nonproliferation have had the unintentioned consequence of encouraging weapons scientists to remain affiliated with the defense institutes in order to be eligible for funding under those programs. In addition, as we have noted, most of the scientists who receive funding under programs such as ISTC or NCI continue to work on WMD development programs at state defense facilities and receive state salaries.[60] For example, apparently almost three-quarters of the Russian weapons scientists who received funding from the ISTC in 2000 continued to work at least 60 percent of full-time levels at their other jobs while receiving ISTC support.[61] While programs aimed at providing research grants to weapons scientists may help reduce potential short-term proliferation activities by meeting scientists' needs to earn a living, these programs continue to support the further development of Russia's advanced military and WMD capabilities. This perpetuates the long-term proliferation problem by helping Russian military scientists retain their skills and retain

employment at the large Russian defense sector R&D enterprises.

As one researcher has noted, programs such as the ISTC were originally intended as short-term measures to provide employment for weapons scientists until the Russian economy developed to provide alternative employment for them.[62] This initial expectation was ill-founded: a decade has passed, and the expected job creation has not occurred. The result has been that Western aid programs are helping Russian weapons scientists retain their military skills, and thus prolonging the potential proliferation situation. For example, a study by Tikhonov reports that 97 percent of the weapons scientists who moonlight to earn foreign stipends say that this work helps them maintain their core job skills, while only 16 percent of those scientists who moonlight for Russian employers say this.[63] Other programs such as the NCI, which are aimed at new job creation, have met only limited success in creating new jobs, and most of the Russian scientists involved continue their Russian state-funded WMD development work. Programs should be restructured to encourage aid recipients to leave their employment at state enterprises.

SUGGESTIONS FOR WESTERN ASSISTANCE PROGRAMS

What can be done to encourage the development of the SME sector in Russia and harness entrepreneurial activity to reduce proliferation? Unfortunately, current trends are troubling because the barriers to SMEs are strong and growing, and the facilitating factors are weak. SMEs are primarily active in lower-tech areas, and thus are not as attractive to Russian technologists as military work. The Russian government has demonstrated a strong orientation on increasing the size of large industrial groups, both in military industry and the general economy, and not on supporting the SME sector.

At the broadest level, the distorted regulatory framework is one of the most significant barriers to the development of a more robust SME sector, yet this is also one of the most difficult problems to address. The problematic investment climate has discouraged FDI or even Russian domestic investment in capital projects. Russia's legislative framework regarding property rights, taxation, and labor relations needs to be improved, and enforcement must be improved across the board. While providing targeted tax privileges for science and technolgy SMEs has not been a standard practice in Western programs, some analysts argue that this type of approach is critical in Russia due to the large and complex tax burden placed on SMEs. An improved economic situation with reduced institutional, administrative, resource, and demand constraints on SMEs would clearly help, but this is a daunting task—systemic reform of the entire Russian economic and regulatory system would be required to address these problems. Nevertheless, at a more limited level, there are a number of ways that Western assistance programs can be modified to help improve the situation somewhat.

Emphasize Market-Driven Commercialization and Business Services.

One of the largest challenges facing many would-be Russian entrepreneurs and scientists is to shift their focus from a technology-push capabilities-driven approach to a market-pull approach. Business and market training, specific market-oriented business services, and the participation of Western industry partners can help prospective SMEs take this market-pull approach. Aid programs also need to focus on market needs and commercialization, and have clear exit strategies that emphasize sustainability. Comparative experiences in other transition economies such as Poland and the Czech Republic have shown that initiatives that shift away from

high-tech efforts and are reoriented towards medium- or low-tech market demand can achieve significant success.[64]

A common thread in many success stories is the direct and early involvement of U.S. or Western industry partners who provide a clear market-oriented approach. Examples include Boeing's Moscow Design Center (which has grown to employ about 650 engineers, scientists, and computer specialists), a U.S. industry software venture in partnership with VNIIEF nuclear weapons lab in Sarov (which has grown to have about 100 former weapons scientists under contract), Motorola and Intel software labs in Russia, and offshore software development companies such as VDI (which has 225 programmers working in its Russian operations for U.S. customers).[65] These are cases where there was little or no involvement of government-sponsored assistance programs. In fact, such government-led programs can sometimes under-perform compared to private-sector initiatives. For example, while the Sarov Open Computing Center (OCC) created with funding from the NCI program has had some success, most of the work conducted to date has been for the OCC staff to build up their skills or for LANL, yet LANL has reportedly not directly benefited.[66] This program is now actively seeking industry partners and potential customers, and recognizes that commercialization is the largest challenge facing the NCI.

In contrast, many international assistance programs have been slow to emphasize commercialization and industry involvement. The U.S. Department of Energy (DOE) IPP program, which was criticized for insufficient focus on commercialization, increasingly shifted to a model focused on industry participation in the late 1990s with promising results, and the ISTC has done the same with its Partners Program begun in 1997.[67] Similarly, the DOE Nuclear Cities Initiative, European Nuclear Cities Initiative, and RANSAC-initiated Nuclear Complex Conversion Consortium are examples of recent steps in this direction, but much more progress needs to be made

towards commercialization and market-oriented programs. Programs must be clearly focused on market demand, avoiding the common approach of focusing on finding U.S. partners for existing Russian products and technologies. U.S. programs could work to focus on market areas where Russian SME products would have a clear market demand. Some examples include supporting the development of Russian SMEs to produce nuclear materials protection, control, and accounting (MPC&A) equipment or specialized technologies for environmental clean-up at DOE sites—these are areas with clear markets in Russia and the United States, involving products that would satisfy U.S. security interests.[68]

Successful policies to support SMEs have also focused on reducing the barriers they face by linking education and entrepreneurship, and by providing services and office space to SMEs. While training programs, business centers, and technoparks can help get SMEs started, the training is often too general or theoretical to be of concrete assistance, and most technoparks are more akin to display halls rather than business incubators.[69] Russian surveys have found that generally the retraining programs offered by many Western aid programs involving generic business skills or direct application of Western approaches are seen as ineffective in helping recipients work within the Russian economic system.[70] Focused programs involving specific technical assistance and business consulting services are much better received, and programs to enhance the marketing skills of Russian defense technologists would be most valuable.

Market forces have led most of the employees who have left military industry to go to work in relatively low-tech sectors such as services, trade, and simple consumer goods production. Entrepreneurs looked to those sectors to make money in the 1990s in Russia, not to technology sectors. While some skilled workers and researchers have moved into companies where they use mathematical and computer skills in areas such as computer programming, banking,

and finance, most new enterprises have not focused on these areas. For example, while a study of the commercialization of military R&D capabilities in Tomsk Oblast found a high level of such activity by the mid-1990s, the most successful new enterprises did not seek to apply or develop high-tech products.[71] Instead, many of the most successful experiences with the commercialization of military-industrial R&D capabilities in Tomsk Oblast were oriented towards clear areas of domestic Russian market demand (usually in consumer goods). One of the most successful new enterprises that the Rubin Submarine Design Bureau began in the 1990s, in addition to its work in support of diesel submarine sales to India and elsewhere, was a business center and the Hotel Neptune, where personnel from the design bureau worked as clerks and service personnel. Workers at the hotel report with satisfaction that, despite initial hesitation about leaving the scientific field, their wages are higher than those of the colleagues they left behind at Rubin's design facilities.[72] Many oft-cited successes, such as the Leninets joint venture with Gillette to produce razors, are also examples of projects where Russian organizations have moved into less-technically advanced commercial areas instead of seeking to apply their R&D capabilities.

Establish Clear Project Goals and Evaluation Guidelines.

As GAO reports and others have suggested, foreign aid programs should have clear project evaluation and approval guidelines, requiring applicants to demonstrate such things as commercial viability and the involvement of industry partners.[73] This is made difficult by the continuing poor economic climate and distortions in market mechanisms, which make it difficult to evaluate economic viability of enterprises or identify niches of potential economic growth.[74] Donor programs should not over-reach in terms of goals for developing sustainable business enterprises. That may not be possible in some locations, such as Russia's

closed cities. Some U.S. programs such as NCI and DEF have disbursed funds before establishing clear program evaluation and approval guidelines tailored to Russian conditions, and have failed to carefully select recipients of assistance. Unfortunately, NCI programs serve as examples of how the lack of clear project goals and criteria can undermine the effectiveness of well-oriented programs.[75] In addition, program activities should be tailored to take account of each enterprise's economic condition, skill sets, etc. Some enterprises are not viable candidates for support. Their financial situation, physical plant, lack of basic competencies, management problems, or ties to military work may make them inappropriate candidates to receive support, and no amount of Western financial or consulting support would make them viable.

Focus on Regional and Local Level Programs.

Regional and local level programs have proven to be most effective in meeting the needs of small businesses, and encouraging the development of critical partnerships between SMEs and local authorities.[76] Local initiatives are often the most cohesive and coherent, and do not overreach or turn into enormous centrally-focused industry support efforts. Some SME support programs at the regional level have achieved significant success in developing positive environments for SME expansion, including programs in areas previously dominated by large military-industrial enterprises. For example, local programs in Zhukovskiy (centered on TsAGI), Tomsk, and Zelenograd are some of the ones that have apparently been able to build coherent support communities to encourage broader development of SMEs.[77] As thousands of personnel left TSAGI in the early 1990s, local employment services encouraged the creation of over 2,000 SMEs that have helped to create over 60 percent of the new jobs in the area. Similarly, an Entrepreneurship Development Department in the Zelenograd region promoted the creation of over 3,000 SMEs with business incubator support, finance programs, and training

programs. By 1997, about 25,000 people were employed in these SMEs, absorbing some of the 40,000 workers whose numbers in the local microelectronic industry were reduced in the mid-1990s. Another local initiative in Tomsk, the Tomsk Business Partnership, has built on the region's positive record of SME support to provide both specialized training and consulting services for SMEs and increased access to investment capital.

Reduced Focus on Short-Term Assistance to Employees at Large or State Enterprises.

Western nonproliferation programs should shift their focus to working with and promoting SMEs and small business consortiums, instead of remaining tied to the large defense sector R&D institutes and industrial enterprises. Encouraging specialists to move to the private SME sector can help reduce the capabilities base of the Russian defense sector, thereby reducing its influence in Russian affairs and reducing the excessive capabilities that seek markets. To encourage this, international donor programs should shift their focus to industry-focused or Russian domestic-style orders, and move away from short-term grants. In addition, major assistance and collaborative programs can better reduce some proliferation concerns by focusing on working with Russian SMEs rather than large enterprises. Unfortunately, some programs such as that for international space cooperation have served to provide significant funding to Russia's large state-run space R&D enterprises, helping them increase salaries and attract skilled young specialists, yet not being able to prevent the proliferation of missile technologies from those enterprises to countries such as Iran. The organizational health and skill sets of specialists at some key Russian missile facilities are better than that at many nuclear weapons enterprises, in part due to the foreign funding provided through international space cooperation projects.[78] For example, in contrast to the situation at most other defense sector enterprises, wages are relatively high and the proportion of

younger specialists is growing at the Energiya Corporation, which has been heavily involved in the international space station project. While numerous other international assistance programs developed to promote the growth of Russian SMEs have played a positive role by providing short-term grants or free business support services, their long-term sustainability is uncertain once foreign funding is reduced.

Unfortunately, some productive short-term responses to the immediate problems affecting Russia's defense scientists, such as the grant programs run by the ISTC and others, have been continued beyond their initial scope due to ongoing economic problems in Russia. In effect, these types of programs encourage the recipient scientists to retain their ties to state-run defense R&D institutes in order to remain eligible for funding. At the same time, many of the scientists continue working on defense-related projects, such that the grants support the continued maintenance of Russia's military-related technical skills and institutes. For example, while the U.S. programs to engage Russian biological weapons scientists in nonmilitary projects have discouraged these scientists from proliferating their skills, these programs, by aiding institutions and subsidizing equipment, may also have served to sustain the scientists' relevant military skills and enhance a possible long-term reconstitution threat.[79]

Compared to other SMEs, those working in the scientific area have the highest percentage of people who have retained their full-time jobs with their previous employers while taking a second job in a small business, with only 30 percent of those working in science-related SMEs doing so on a full-time basis.[80] This issue raises serious considerations for planning assistance programs because short-term assistance to personnel likely to remain employed at the state organizations may prolong or worsen the longer-term proliferation problem. Programs focused on research grants and finding support for Russian capabilities generate only short-term benefits, rather than

the longer-term benefits that can be obtained by market-focused programs that encourage SME growth.

Improve SME Access to Finance Sources.

As noted, the lack of access to financial resources is one of the key barriers continuing to hamper the development of the SME sector in Russia. Many successful OECD SME support programs have focused on providing finance instruments such as specialized banks and loan guarantee programs for SMEs. These programs need to be application-driven, with merit-based evaluations leading to provision of small seed capital to SMEs seeking to start new enterprises or upgrade capabilities. For example, the Fund for Small Enterprise Development Assistance in Science and Technology has provided subsidized loans to many SMEs, but it handles only about $4 million in loans a year.[81] There is justifiable reluctance on the part of some donors to provide finance programs until the macroeconomic policy environment and governmental regulatory systems are improved, but focused OECD and other programs provide examples of how such programs can be successfully implemented even without macroeconomic policy improvements.

Beware of Dismantling SME Barriers that Discourage Proliferation.

On a final cautionary note, it is important to recognize that under some conditions, some of the factors that discourage entrepreneurial activity also serve to discourage some types of proliferation. For example, while security restrictions, administrative barriers, lack of financing, and the passivity of many Russians are all factors that hamper the expansion of the SME sector in Russia's closed cities, these same factors also hamper potential access to these cities by undesirable foreign actors and restrict the movement of individual weapons specialists out of those closed cities. Commercial trade activity by companies that

have rented space in newly-accessible buildings associated with Russian nuclear weapons facilities has increased the degree of poorly-regulated trade in the immediate proximity of facilities and materials of proliferation concern. Programs to encourage the creation of consulting groups and firms by weapons scientists can help them develop business skills for commercial work, but also provide them with mechanisms they could use for proliferation of their military skills. Thus, those proposing programs to promote the expansion of entrepreneurial activity and the SME sector need to consider this duality when seeking to reduce some of the barriers that SMEs face. This subject is discussed further in the Appendix to this chapter.

ENDNOTES - CHAPTER 7

1. This issue is discussed in more detail in the Appendix to this chapter.

2. While there has been significant demilitarization, there has not been any significant conversion. The decline in military output has not led to the productive reallocation of freed-up resources to boost civilian production. See John S. Earle and Ivan Komarov, *Measuring Defense Conversion in Russian Industry*, Stockholm, Sweden: Stockholm School of Economics SITE, 1998, pp. 4-5, available online at *www.hhs.se/site/Publications/workingpapers/workingpapers.htm*; Kevin O'Prey, *A Farewell to Arms? Russia's Struggles with Defense Conversion,* Washington, DC: The Brookings Institution, 1995, pp. 12-14. Many U.S. programs aimed at assisting in the conversion of the Russian defense industry also met with little success. For example, high-profile programs such as the U.S. DSWA-run Fast Four conversion effort and the Defense Enterprise Fund (DEF) expended significant funds but largely failed to achieve their objectives. See U.S. General Accounting Office (USGAO), *Cooperative Threat Reduction: Status of Defense Conversion Efforts in the Former Soviet Union*, Washington, DC: GAO/NSIAD-97-101, April, 1997; Matt Bivens, "Investing, Pentagon-Style," *Moscow Times*, April 4, 2001; Sergey K. Kolpakov, "The Era of East-West Joint Ventures," in Vlad E. Genin, ed., *The Anatomy of Russian Defense Conversion*, Walnut Creek, CA: VEGA Press, 2001.

3. Comparisons across countries and time periods are hampered by differing definitions of "small" and "medium" sized firms. In Russia,

legal and regulatory changes in 1995-96 changed the definitions for "small business," reducing size limits for some sectors from 200 to 100 employees for industry and construction (the maximum size is 60 for R&D, 30 in trade and services, etc.) and requiring that the share of ownership by entities outside the company (governments, NGOs, other legal entities) be less than 25 percent. The Russian definition of a "medium" business is one having 100 to 300 employees. See Leonid Polishchuk, *Small Business in Russia: Institutional Environment*, Publication No. wp240, University of Maryland, College Park: Center for Institutional Reform and the Informal Sector, 2000; S. A. Smirnov, *Maloye Predprinimatel'stvo: Obshchestvennaya podderzhka I sodeystvie rasvitiyu*, Moscow: TOO KONTUR, 1999, pp. 45, 73; *Resursnyy Tsentr Malogo Predprinimatel'stva* (RTMP), *Rossiskoye maloye predprinimatel'stvo v tsifrakh*, Moscow: RTMP, 2000, available online at *Docs.rcsme.ru/rus/RC/statistics* (hereafter RTMP, 2000a); OECD Centre for Co-operation with the Economies in Transition (CCET), *Entrepreneurship and Small Business in the Russian Federation*, Paris: OECD CCET/DT(9811), February 20, 1998, section 1.3. In the EU, SMEs are defined in terms of employment as having less than 250 employees.

4. Polishchuk and Smirnov note the number of SMEs fell to 3.6 per 1000 population in Russia after the 1998 crisis.

5. Controls on private enterprise were loosened somewhat during the period of Gorbachev's rule and perestroika. The 1988 Soviet Law on Cooperatives opened the door for internal spin-offs within state enterprises, and many entrepreneurs made use of this law to open small consumer-oriented cooperatives.

6. While official employment figures do not include firms in the underground economy or firms that under-report to avoid taxes, this omission is offset by the inclusion of nonperforming and "shell" firms set up for other reasons, so that some analysts feel the official numbers are a reasonable reflection of the actual situation. See Polishchuk; and OECD CCET (1998), esp. section 1.3. Surveys have also recognized the stalled SME sector. See Theodore Gerber, *The Development of Self-Employment in Russia*, Program on New Approaches to Russian Security, PONARS Memo no. 186, 2001, available online at *www.fas.harvard.edu/~ponars*.

7. See OECD CCET, p. 35, on innovative SMEs; and Polishchuk, section 3.1. Most SMEs in Russia are in the trade sector (43 percent of all SMEs in 1996), construction (17 percent), and industrial production (metal working, light industry, wood manufacturing, food industry, 15 percent), while scientific services make up only 6 percent of the total.

While innovative businesses are not registered in Russian statistics, it is estimated that in 1996 some 40,000 firms were involved in creating new production methods or new technologies, with 4,000 of those dealing with scientific services.

8. *Kommersant*, 3/16/00, as cited in Polishchuk, p. 4; OECD CCET, esp. section 1.5.

9. This section draws on Polishchuk's excellent survey of SME, as well as Gonchar; RTMP, 2000a; RTMP, *Issledovaniye administrativnykh bar'yerov*, Moscow: RTMP, 2000, September available online at *www.rcsme.ru* (hereafter RTMP, 2000b); OECD Centre for Private Sector Development (OECD CPSD), Forum on Entrepreneurship and Enterprise Development: Report on Meeting of Working Party I on Institutional Framework for Entrepreneurship, Paris: OEDC, March 1998.

10. See analysis in RTMP, 2000b.

11. McKinsey Global Institute, *Unlocking Economic Growth in Russia*, chap. 3, "Software" section, and exhibit 13, 1999. Available online at *mgi.mckinsey.com/mgi/russian.asp*.

12. O'Prey, p. 20.

13. For example, see discussion in Stanislav Menshikov, "Stsenarii razvitiya VPK," *Voprosy Ekonomiki*, July 1999, on approaches in the scientific-industrial complex.

14. See N. Tsagolov, presentation at January 20, 1999, conference on "Obsuzhdeniye problem kommertsializatsii NIOKR," sponsored by ECAAR-Russia, on commercialization of R&D (NIOKR); Nonna Barkhatova, "Russian Small Business, Authorities and the State," *Europe-Asia Studies*, June 2000.

115. See U.S. Government Accounting Office, *Nuclear Nonproliferation: DOE's Efforts to Assist Weapons Scientists in Russia's Nuclear Cities Face Challenges*, Washington, DC: GAO-01-429, May 2001, p. 21 and Appendix III.

16. Gonchar, p. 19; Barkhatova; and Polishchuk.

17. This has been particularly problematic in the defense sector, as enterprises have sought to "convert" only to find too many firms chasing small market niches. See Yevgeny Kuznetsov, ed., *Learning to Restructure: Studies of Transformation in the Russian Defense Sector*,

BICC Paper no. 3, Bonn: Bonn International Center for Conversion, 1996, Part I.

18. McKinsey Global Institute, as cited in Gonchar, p. 20.

19. McKinsey Global Institute, p. 6, evaluated how continuing government subsidies and dominance of well-connected large legacy enterprises hinder the growth of potentially productive new companies.

20. Judith B. Sedaitis, "Commercializing State-Owned R&D: A Russia-United States Comparison," and Andrew J. Aldrin, "Defense Enterprise Adaptation in St. Petersburg," in *Commercializing High Technology: East and West*, Judith B. Sedaitis, ed., New York: Rowman & Littlefield Publishers, 1997, cite these factors, suggesting that they may help account for why Scientific Research Institutes (NII) have been less open to reorganization and new approaches than Design Bureaus (KB), and why KBs have been less open to restructuring than Scientific Production Associations (NPO) and Production Associations (PO).

21. CENTRA project experiences; see also Ross Kerber, "To Russia With Cash," *Boston Globe*, May 7, 2001.

22. For example, see discussion in David M. Bernstein, "Toward Cooperative Ventures with Russian Defense Enterprises," in Vlad E. Genin, ed., *The Anatomy of Russian Defense Conversion*, Walnut Creek, CA: VEGA Press 2001, p. 670.

23. For example, see Barkhatova.

24. Valentin Tikhonov, *Russia's Nuclear and Missile Complex: The Human Factor in Proliferation*, Washington, DC: Carnegie Endowment for International Peace, 2001, pp. 55-57, or online at *www.ceip.org/npp*.

25. Gonchar, p. 29; Polischchuk; and Leonid Ya Kosals, Rozalina R. Ryvkina, and Michael D. Intriligator, "Russia's Defense Enterprises: Between the State and the Market," in Vlad E. Genin, ed., *The Anatomy of Russian Defense Conversion*, Walnut Creek, CA: VEGA Press, 2001, argue that privatization has not provided effective new owners.

26. O'Prey, p. 48.

27. *Ibid*., pp. 61-68, notes the resistance of defense industry managers to change, and their continuing ability to stifle alternative developments, as one of the major reasons for the failure of conversion and reform in the Russian defense sector.

28. See comments of Clifford Gaddy and Glenn Schweitzer in Glenn Schweitzer and Lev Tocheny, "Nuclear Perestroika: Techno-Business in Russia's Atomic Cities," presentation at MIIS Center for Nonproliferation Studies seminar, February 23, 2001, available online at *ransac.org/new-web-site/ccc/nuclear_perestroika.doc*. For example, VNIITF created the SPEKTR joint stock company for commercial projects, but recent reports indicate that most VNIITF workers have been recalled back to the lab because the lab director wanted a larger defense work force to ensure more Minatom funding. For a presentation on job creation in the closed cities, see Sharon Weiner and Oleg Bukharin, "Job Creation Efforts by the Closed Cities," at RANSAC Workshop on New Perspectives on the Future of the Russian Nuclear Weapons Complex, held December 19, 2000, available online at *ransac.org/new-web-site/ccc/dec_workshop.doc*.

29. See L. Konareva, presentation at January 20, 1999, conference titled "Obsuzhdeniye problem kommertsializatsii NIOKR," sponsored by ECAAR-Russia, on commercialization of NIOKR.

30. Some examples of such organizations include Leninets Holding Company, Rubin Marine Design Bureau, Ioffe Robotics NII.

31. Gonchar, 1998, p. 49.

32. Gonchar, 1997; Menshikov, 1999b; Earle & Komarov, p. 12, citing Glukhikh. See Yu. V. Perevalov, et al., *Konversiya I restrukturizatsiya oboronnogo kompleksa: regional'nyye problemy I perspektivy*, Yekaterinburg: Institut ekonomiki UrO RAN, 1998, p. 5; Menshikov, 1999b, on size of defense R&D sector.

33. For example, see Gansler, 1997; and Sedaitis, 1997.

34. Gonchar, 1997, has undertaken valuable work to compile official and unofficial data to help get a better picture of this activity, while Gansler, 1997, and Aldrin, 1997, have written on the separation of NII, KB, NPO, etc.

35. O'Prey, pp. 16-21; Kosals, et al., 2001, note the continuing dominance of large firms in defense sector.

36. Gonchar, p. 49; Harley Balzer, "Dismantling Russia's Technotopia: Six Ministries in Search of an Industrial Policy," in Judith B. Sedaitis, ed., *Commercializing High Technology: East and West*, New York: Rowman & Littlefield Publishers, 1997.

37. Leonid Kosals, "Retsept Vyzhivaniya Oboronnogo Komplksa" ["*A Prescription for Survival of the Defense Complex*"], Nezavisimaya

Voyennoye Obozreniye, January 28–February 3, 2002, as cited in Gonchar, p. 49.

38. CENTRA personnel visits; Menshikov, 1999b.

39. For example, see Gonchar, pp. 16ff.

40. Gonchar; Aleksey N. Shulunov, "Symptoms of Paralysis," in Vlad E. Genin, ed., *The Anatomy of Russian Defense Conversion*, Walnut Creek, CA: VEGA Press, 2001, p. 345; and others estimate that arms exports make up about 60-70 percent of all Russian defense industry military sales. For example, Gonchar, Figure 8, shows that in 1998 arms exports accounted for up to 84 percent of the military output of the aerospace sector and 59 percent of the shipbuilding sector.

41. See, for example, the Deputy Prime Mnister Klebanov initiative as reported in V. Zmeyushchenko and Ye. Titova, "The New Line of the Defense Industry," Profil 5/7/01, as cited in *Foreign Broadcast Information Service (FBIS)-CEP*20010507000275, 2001; Dmitriy Safonov, "Military-Industrial Complex Is In for Revolutionary Upheavals," *Izvestiya*, March 29, 2001, in *FBIS-CEP* 20010329000312, on defense industry reforms; statements of Directors of the Russian Armaments Agencies in "The Defense Complex's Today and Tomorrow," *Krasnaya Zvezda*, December 23, 2000, as cited in *FBIS-CEP*20010103000217; and Alan Cullison, "Merger Mania Hits Russian Economy, and Anti-Monopoly Minister is Smiling," *Wall Street Journal*, June 6, 2001.

42. Author interviews with remote sensing and information technology specialists who previously worked on classified projects in Moscow-based institutes, 1999, 2000, and 2001.

43. Tikhonov, *Russia's Nuclear and Missile Complex: The Human Factor in Proliferation,* Washington, DC: Carnegie Endowment for International Peace, 2001, Section 6, or online at *www.ceip.org/npp*. It is estimated that 6 to 10 million people worked in Russia as part of the Soviet defense industrial sector in the late 1980s, but that by 1994 this was down to 4.5 million people, falling to 3-4.5 million in 1995, and then 2.7 million in 1997. See Gonchar as cited in O'Prey, p. 45; Menshikov; Earle and Komarov, p. 12, citing Cooper, Glukhikh, and others; Shulunov, p. 387. Noting that the number of inventions has fallen significantly, see Arkadiy Yarovskiy, "Brain Drain: The Loss of Intellectual Capital," in Vlad E. Genin, ed., *The Anatomy of Russian Defense Conversion*, Walnut Creek, CA: VEGA Press 2001, p. 388.

44. Earle and Komarov, citing official Russian government data.

45. Author interviews with Department heads at MFTI, Bauman, ITMO, and ex-LETI in 1992, 1995, and 1996. See also Gonchar, p. 37.

46. Putin speech of March 21, 2000, in Nizhny Novgorod, *Economic Reform: The Case of Nizhniy Novgorod Oblast*, Paper 14, Bonn, Germany: Bonn International Center for Conversion, May 2000, available online at *www.bicc.de/info/briefs.html*.

47. Menshikov, "Stsenarii razvitiya VPK," *Voprosky Ekonomiki*, July 1999.

48. Gonchar, pp. 44-45ff. Within this overall decline, some sectors stand out as having relatively high continuing military production—in 1999 the shipbuilding sector's military output was still at 50 percent of its 1991 level, space was at 41 percent, and military output in the nuclear and radio industries was at 34 percent of the 1991 level. In contrast, military output in 1999 was under 15 percent of the 1991 level in the electronics, communications, and aircraft industries.

49. Gonchar, 2000.

50. Kosals, *et al.*, 2001.

51. For example, see World Bank/UNESCO data as reported in American Chamber of Commerce in Russia, *Whitepaper on Offshore Software Development in Russia*, 2001, pp. 9-12, *www.amcham.ru*, which notes continuing high enrollment in science programs and international recognition that Russian technical students continue to attract in international competitions, etc.

52. Author interviews with MFTI, St. Petersburg Electrotechnical University and other directors in 1994-96.

53. For example, interview with ex-Ioffe First Deputy Director Grigor'yev, 1994.

54. McKinsey Global Institute, 1999, Software chapter.

55. American Chamber of Commerce in Russia; Kerber, 2001.

56. For example, Gonchar, p. 53, points to companies such as Russkaya Avionica, Kronshtadt, Transas, and others.

57. Numerous studies have reviewed international aid programs, but find it difficult to quantify results. For example, see OECD CCET, 1998, section 3.6.

58. Gonchar, 1998, p. 40.

59. For example, see Gonchar, 2000, p. 44.

60. U.S. General Accounting Office, *Biological Weapons: Effort to Reduce Former Soviet Threat Offers Benefits, Poses New Risks*, Washington, DC: GAO/NSIAD-00-138, April 2000. USGAO, 2001, notes some of the problems the NCI has encountered in its start-up phase, and the lack of clear plans or assessment measures to ensure that funded projects meet program objectives of job creation.

61. Calculated from data published in the ISTC Annual Report, 200, p. 7.

62. Tikhonov, "The Nuclear Brain Drain Coninues," *Moscow Times*, May 15, 2001.

63. Tikhonov, *Russia's Nuclear Missile Complex*, 2001, p. 75.

64. For example, see studies by Bernstein, 2001; Gansler, 1997; and assessment of USAID New Business Development Program activities, 1993-1997, in International Labour Organization, a report on business development services in Russia. International Labour Organization, 2000, available online at *www.ilo.org/public/english/employment/ent/papers/russia.htm*.

65. See Kerber, 2001; USGAO, 2001, p. 44; McCullough, 2001.

66. USGAO, 2001, p. 16; U.S. Department of Energy (USDOE) Nuclear Cities Initiative Program Plan, Washington, DC: USDOE National Nuclear Security Administration, 2000, available online at *nci.nn.doe.gov*. Ascribe News 2001, "New York Engineering Software Firm Signs Contract with Computer Center in Russian Closed Nuclear City," March 30, 2001, notes a recent NCI success with the signing of an $84 thousand contract to provide computer modeling support for a U.S. company.

67. For example, see USGAO, 2000; USGAO, 2001, for criticism of IPP; and ISTC, 2000.

68. These ideas have been generated by RANSAC programs, as in Bukharin, Bunn, Luongo RANSAC report, 2000, and are being pursued by the Identification Technologies Company based in Snezhinsk that is getting support from the DOE NCI—this is an example of a high-tech market niche for Russian SMEs.

69. Vadim Radayev, presentation at January 20, 1999, conference titled "*Obsuzhdeniye problem kommertsializatsii NIOKR*," [Discussion on Problems of Commercializing R&D] sponsored by ECAAR-Russia, held at the Institute of International Economic and Political Research (IMEPI), Russian Academy of Sciences.

70. For example, see Gonchar, 1998, chap. 5, surveys from Nizhny Novgorod Oblast.

71. Radayev, 1999a, reports on OECD-funded study in Tomsk Oblast. See also Maksim Masharuyev, "Technology Offers Opportunities in Tomsk Oblast," *BIZNIS Bulletin*, March 2001, on technology opportunities in Tomsk Oblast.

72. Author's discussions during several visits to Rubin and stays at their Hotel Neptune in the mid-to-late 1990s.

73. USGAO, 2001.

74. Discussed in Gonchar, 1998.

75. USGAO, 2001.

76. OECD CCET, 1998; and OECD CPSD, 1998.

77. OECD CCET, 1998, chap. 3. Also see Alan Moseley, "The Tomsk Business Partnership," in Eurasia Foundation, May, 2001, on Tomsk.

78. Tikhonov, 2001a. See also Michael Eisenstadt, "Russian Arms and Technology Transfers to Iran: Policy Challenges for the US," *Arms Control Today*, March 2001, for discussion of Russian organizations allegedly assisting Iran missile program.

79. See USGAO, 2000.

80. OECD CCET, 1998, p. 36, Table 6.

81. *Ibid*., chap. 3, contains numerous examples of such programs, but many of them are small, not coordinated, and not focussed on R&D or projects coming out of the defense sector.

CHAPTER 7

APPENDIX

POTENTIAL IMPACTS OF SME EXPANSION ON PROLIFERATION

At the most basic level, any supply-side strategy to reduce the proliferation of strategic weapons and technology from Russia can seek to eliminate Russian capabilities of concern, or to discourage those in Russia who possess those capabilities from proliferating them. Demilitarization leading to the total elimination of advanced Russian R&D or production capabilities in a certain military-technical area would eliminate Russia's ability to proliferate in that area, but it is not clear that it is possible or advisable to seek such a total degree of demilitarization.[1] While some military-related assets and capabilities can be reduced or eliminated within a relatively short time span, other assets are more durable or easily reconstituted. For example, military-industrial and R&D capabilities can decline rather quickly when core teams of personnel break up, production equipment ages or is put to other uses, or military scientists and technical personnel begin working on civilian projects and begin to lose their cutting-edge skills.[2] Nevertheless, some core WMD knowledge can remain of proliferation concern for decades even if the specialists are not actively developing or using the related skills, and it is highly unlikely that Russia will forfeit or lose its ability to produce advanced strategic weapons.

Thus, we need to consider what types of activities, conducted by whom, should be addressed in order to discourage Russian proliferation of key capabilities or

weapons systems abroad. For example, while the proliferation of operational weapons systems requires that the Russian government sell weapons from its stockpiles or that enterprises produce these weapons, the proliferation of scientific-engineering expertise simply requires individuals who possess specialized knowledge and are willing to provide it to foreign customers. While a full explication of all the factors that can encourage proliferation behavior by Russian state bodies, enterprises, groups, and individuals is beyond the scope of this chapter, it is important to identify these domestic factors in order to consider how an expansion of Russian entrepreneurial activities may affect them.

At the central government level, Russian proliferation activities are encouraged by such factors as the pursuit of strategic national interests, hard currency earnings, and alliance relations. At the ministry or enterprise level, weapons proliferation may allow organizations to maintain core production capabilities or skills, earn higher profit margins than in alternative activities, avoid restructuring or retooling, retain influence, pursue parochial interests, and take advantage of existing marketing capabilities. At the individual level, weapons proliferation can enable military-industrial directors, staff, and scientists to continue activities they know and like, earn money, avoid the need to seek new employment, retain influence, and follow belief systems. The motivating factors above are not independent of each other—some are interrelated—but they are distinct enough to be treated as separate drivers of proliferation activity. Many of these powerful domestic factors can act to encourage continued Russian proliferation activities even in the face of international opposition, control regimes, or significant demilitarization at home.

How could expanded entrepreneurial activity affect the factors that encourage proliferation behavior by the Russian government, enterprises, or scientists and other individuals? A summary of these influences, with each rated from minimal to significant, is shown in Table A-1. At

the state level, Russia's perception and pursuit of its national interests or alliance relations are unlikely to be affected by an expansion in SME entrepreneurial activities. It is conceivable that a major expansion of the SME sector in Russia could shift the sources of influence in the Russian political system, give new actors a greater voice, and lead to a revision in how the Russian government perceives its national interest, thereby reducing the attractiveness of weapons proliferation for Russian policymakers, but these eventualities must be considered highly unlikely. Thus, an expanded SME sector would have insignificant impact on these factors that promote proliferation. Similarly, the government's incentive to export arms in order to earn hard

Level	Factors Encouraging Proliferation	Potential Impacts of Expanded SME Sector
Government	Leaders view arms sales as being in the national interest and a tool to support alliance relations	Minimal
	Leaders view arms sales as an effective way to earn hard currency	Minimal
	Government seeks to put excess military industrial and technical capacity to use	Moderate
Ministry/ Enterprise	Organizations seek to maintain core military-related production capabilities and skills.	Minimal
	Traditional military-industrial views and organizations are influential within the government	Moderate
	Organizations view arms sales as a good way to increase revenues and profits, provide employment for personnel, maintain influence, and avoid need to convert or restructure.	Moderate
	Access to foreign arms markets is aided by active and experienced marketing organizations.	Moderate
Individual	Workers have ideological beliefs about supporting recipient governments or nonstate groups	Minimal
	Workers enjoy and feel competent in military work.	Moderate
	Workers view military work as best way to earn money, remain employed, and retain social position.	Significant

Table A-1. Potential Impacts of SME Expansion.

currency will not be directly affected by an expansion in entrepreneurial activities, unless this expansion leads the Russian government to be more concerned than it would be otherwise about Western sanctions in response to Russian proliferation activities. Potentially the largest impact that expanded entrepreneurial activities might have on proliferation drivers at the government level would be if the expansion of SME activities reduced the need to find alternative uses for excess military-industrial and technological capacities. In this way, expanded SME activities could moderately reduce incentives for the Russian government to proliferate for this reason.

At the ministry or enterprise level, an expansion in entrepreneurial activities can have somewhat greater impacts because it would directly address some of the key factors that encourage proliferation by actors at this level. For example, a robust SME sector could reduce the influence of the traditional military-industrial complex, and thus reduce the ability of these ministries or enterprises to successfully advocate foreign arms sales. Similarly, expanded entrepreneurial activities could provide alternative sources of employment and profits for enterprises, but are likely to reduce the attractiveness of arms sales in this regard only if the large organizations believe they can remain influential and in control as SME activities increase. An active SME sector could also develop better access to critical foreign markets, thus providing alternative market access to that provided by Rosoboroneksport. Nevertheless, it is hard to envision how an expansion in SME activities would reduce the incentives for industrial ministries or their production enterprises to export weapons abroad in order to maintain core military production capabilities and skills or to retain their influence.

In terms of individual scientists and other personnel, an expanded SME sector could have major impacts in reducing the importance of proliferation drivers that act at this level. A flourishing SME sector could provide alternative sources

of employment, salaries, and social influence to reduce individuals' reliance on military-related work supported by foreign arms sales revenues. While some job positions in the SME sector can provide interesting and challenging work for technical personnel, this may have only a moderate impact on reducing the attractiveness of military-related work because many SME positions in Russia are likely to be in lower-tech sectors or involve work that individuals find less intellectually interesting than their previous work in defense R&D. Finally, at this level it is unlikely that SME activities will reduce the role of ideological beliefs in promoting arms sales, but this is probably a rather minor driver of proliferation activity.

Thus, as indicated in this overview, it is likely that an expansion in Russia's SME sector can play a role in reducing proliferation activity in Russia, but there are also significant factors encouraging proliferation that would not be affected by an expanded SME sector.

ENDNOTES - APPENDIX

1. Many Russian analysts and officials are concerned that Russia's military-technical capabilities are declining to such low levels that they may fail to support Russia's stability and basic national interests. For example, Tikhonov, 2001a, argues that the lack of skilled technical personnel and industrial capacity in the nuclear weapons and power sector may threaten Russia's ability to safely manage its nuclear weapons stockpiles or nuclear power industry.

2. Personnel who shift to work on civilian projects often lose their technical qualifications because the civilian work is less advanced than the military work. For example, Russian military-industry directors have noted in interviews that work to design, weld, and produce civilian tankers is simpler and less demanding than the work involved in producing submarines.