The Military Industrial Complex

A Kennaway

Unlike the Western system, the Russian Military Industrial Complex (MIC) is organised into several and, in the main, distinct components: R&D, design and prototyping, direct manufacture and some indirect sub-contracting factories to the main factories. All these units are very much bigger than in advanced industrial countries (AIC) and are, for that as well as for other structural reasons, extremely inefficient.

Secrecy, Soviet/Russian habits of exaggerating and producing data without proper foundation all make it hard to determine, with even sensible accuracy, the size and numbers involved in the defence industries. The following table from an authoritative Russian source, shows clearly the Soviet preference for big factories in the MIC.

Size distribution of enterprises[1] in percentages of each category

No of workers	<200	201-500	501-1000	1001-5000	5001-10,000	>10,000
All industry	66.2	16.2	8.2	7.7	1.1	0.6
Defence industry	0.3	1.6	3.9	49.8	28.3	16.1

These dinosaur MIC factories represent a massive section of the resources of Russia. In Soviet times the State was primarily organised for military purposes and the sums allocated were around a third of GDP. This figure is now probably between 7-9% of GDP, which itself is around 40% of what it was, ie the current defence expenditure lies between 1/8th and 1/10th of the Soviet figure. Hardly any of that is spent on new material purchases but most of the key R&D and design centres receive enough funds to survive; they of course keep on claiming that the figure is woefully inadequate. None of the factories have been closed or liquidated in spite of the fact that they are bankrupt, as Russian commentators regularly report.

Nothing practical has happened during the 12 years of talk about converting the MIC to making more civilian goods, to rescuing them from making persistent losses. Indeed one must conclude that the Russian leadership has every intention of retaining the old soviet structure, size and organisation of the MIC in spite of a drastically reduced State budget and income. They propose to finance this ostensibly through income from export of arms; the receipts of roughly $2Bn yearly do not make this possible. One may confidently guess at their reasons:

* Military expenditure embraces most of the spend on “science”, prestige space projects and a highly visible armed force. These elements traditionally command the respect of a vociferous and perhaps significant section of the population, especially its communist adherents, nationalists and chauvinists who wouold like to believe that the role of Russia as a Great Power requires foreigners to respect and fear the Armed Forces of Russia.

* The MIC embraces the least bad elements of Russian manufacturing industry; apart from military applications, there is little else of note in Soviet/Russian civilian science nor in the design of civilian products and systems. Soviet Russia has earned only 10

Nobel prizes in natural sciences, the same as Holland with a twentieth of the population.

* The leadership, whether military, political or scientific and technical, is accustomed to the past, which by its own lights delivered successfully the demands of the regime.

* They regard all western advice as motivated by the will to destroy the basis of science and technology and more especially of the military potential based on the MIC.
* They seem to be afraid to make the fundamental changes necessary, partly because the process will take several decades and this does not match the traditional Russian desire to do everything quickly.

* They fall into a familiar trap; thinking that they need huge investments and new technology to convert their defence factories successfully. They have a history of throwing money lavishly at the factories; these were usually hugely over-invested with new equipment which was often misused. It is true that the average MIC factory is a poor place and in an AIC would be closed, the equipment sold at auction, the site razed to the ground and the work force retrained and dispersed. But Russian realities do not allow that as a first step. It is indeed possible, given the necessary authority, for a competent Chief Executive Officer to return a profit reasonably quickly. But there are few if any CEOs who really could perform in a competitive market fashion.

* It is also possible that they realise that they are incapable of undertaking the necessary reforms at the base of affairs on their own. They would need a long period of foreign expertise applied within the MIC. Russians are often proud, sensitive and insecure and such a step would require them to swallow their pride, however tactfully the job were to be done. Unfortunately much of the work, for example by consultants appointed and funded by the EU programme TACIS, has been demonstrably inappropriate to the local circumstances. As a consequence, little progress has been made.

This is a tragedy for Russia. The end result of successful reconstruction would be to equip Russia with a far more effective defence industry, whose real costs would be well below those currently ruling; furthermore they would possess a wide range of separate prime contractors of civilian products and services and a normal structure, as in the AICs, of suppliers and sub-contractors to both the military and civilian producers capable of competing for their own and foreign civilian markets.

The consequence of their present stance is that the MIC will continue to stagnate, to be under employed, to be a massive drain on the resources of the state budgets at every level and to divert badly needed resources from the essential tasks required to reverse the negative trends in real wealth and health of the nation.

However, the MIC will remain capable of:

* responding to the scenario set by the MOD for imaginative ideas for novel and advanced weapon systems. Fewer may be offered than in Soviet times for the military to choose from but some internal discipline will not be detrimental to the end result.

* delivering for export, to the MOD as well as to the para-military organs of the State as many weapons and equipment as demanded, if and when finances allow.

This capability will be worse than it was when ruled by the inefficient but still

operating Soviet parameters of the industrial organisations. Good ideas were always degenerated and constrained by industrial performance in Soviet times. The system will have deteriorated further, for reasons discussed below.

There is, however, one significant source of improvement which we must be aware of, namely the fact that the fSU is now barely constrained from acquiring the latest electronic components, as well as other high-tech components for weapon systems. These will be incorporated in C3 equipment and in systems for control of machinery. They can also buy most "state of the art" laboratory instrumentation and production equipment.[2] It is possible but unlikely that the Russian system will, unaided by the transfer of "soft technology", become competent at getting the results from their purchases of laboratory and production hardware to which we are accustomed. The upshot is that modern equipment will be installed in military hardware but the high reject rates experienced in the factories will only very slowly approximate to standards of the AICs.

Description of the Russian MIC

The Soviet MIC probably employed on military work 12-16 million people[3] out of the working population of 67.7 million; probably half that number directly in the factories of the prime contractors. It employed over two thirds of all qualified scientists and engineers (QSE). These, according to figures given by a deputy Minister for Science in 1995, amounted to 2.7 million in 1991. Post Soviet Russia, with an able-bodied population of around 71 million, retained between 60-80% of these totals; half in the Moscow Region and another quarter in the St Petersburg Region. Nearly all the R&D and design Institutes are there, with manufacturing scattered all over the former Soviet Union. The defence budget for equipment, on R&D and all phases up to and including manufacture in Soviet times was secret. One recent article[4] gave the following analysis, in percentage terms of the defence budget for 1991 and 1995: Equipment 36.3% and 18.8%; R&D 13.6% and 18.8%; Manpower 38.6% and 54.6%. But there is no provenance for these data and therefore little credence can be given to them.

Official Russian pronouncements on the MIC, in common with other matters, provide figures that vary according to the speaker and his purpose in making the statement. Current estimates for the MIC of the Russian Federation lie between:

* 2,700 and 4,000 factories

* 4-6 million employees. In December 1997 Ya Urinson said[5] that there are more than 2 million direct employees in 1,700 firms in eight sectors which will be given priority (out of a total work force of about 40 million).

* 200-400 R&D establishments. There are other estimates from equally knowledgeable Russian leaders of the MIC. For example in 1995 Viktor Glukhikh, then the hardened, Cold-War dedicated chairman of the State Committee for the defence industries - since abolished - quoted 660 military scientific institutes. To these must be added the many institutes of the Academy of Sciences, sections of so-called civilian institutes of higher education involved in research and teaching.

* between 800,000 and 1.2 million QSE (out of 2.7 million total in the last years of the USSR)[6]. If indeed we accept the figure of 80% working for the military then the USSR QSE in that role numbered 2.16 million. Other reports say that between 800,000 and 1.2 million have left military work since then.[7] This would leave between 1-1.2 million

in post. This correlates quite well.

Many of the R&D and design Institutes are now "hollow", like the Armed Forces themselves, with fewer staff. The intention is not to close or merge them, but to maintain their skeleton existence in the hope of later expansion again to support only the military.

Regional distribution

Russia has retained practically the whole of the creative and intellectual ability of the USSR to conceive, design and make a prototype of weapons and weapon systems. It has, however, lost to the newly independent States a significant part of raw material deposits, their primary conversion into semi-finished technical materials, assembly factories and component manufactures. The loss of Baykonur to Kazakhstan is also important for the testing of ICBMs and space work. This has resulted in an expensive rental deal between the two States and also some improvisation to substitute other stations within the Russian Federation. Also lost is the vertical structure of command within Russia and also within the old USSR from Ministry to operating unit, with its system of instructing them to make products and transfer to specified users. The factories have to make horizontal arrangements between themselves. Much of this is arranged through the inefficient system of barter or paying by issuing IOUs. The Russians have been trying hard through the economic committee of the CIS to revive the Soviet structure of cooperation. Belarus, Ukraine and Russia have given formal approval but there is a long way to go before this will produce practical results.

Alexander Ozhegov[8] gives the following data:
Many of the uranium mines were in Siberia, Kazakhstan, Tajikistan and Uzbekistan; one was in Estonia. Many of these were closed even before the USSR collapsed. In 1990 20,000 tonnes was produced but the demand was only 9,000 tonnes. All the enrichment plants were in the RF, mostly in 10 closed cities. These have no other employment.

Much of the electronics industry was in Belarus and in Ukraine which produced low grade silicon. Many western specialists have worked in these factories; their standard is depressingly poor; most of their products are uncompetitive. These factories depended on gold and other minerals from Siberia. Russia was building a replacement factory in Krasnoyarsk.

There is a heavy concentration of shipbuilding in Ukraine but this depends on engineering supplies from across the USSR, especially Russia. There is also a large tank factory and a missile factory in Ukraine as well as the Antonov aircraft design, R&D and manufacturing complex. Russia is trying hard to persuade the Ukrainians not to compete but to collaborate with them in arms exports.

Ozhegov wrote that, rather than to name the regions with a heavy concentration and dependency on the MIC, it was easier to identify the Regions of Russia that had few if any defence industries. These are: Kuban, Kuzbass, Tyumen, Bashkiria, Northern Siberia, Yakutia and Kamchatka.

On average the share of the MIC in the regional industry lies between 30-40%, rising to 50-60% in some cases. Udmurtia was an extreme case, where 14 defence factories produced 80% of the whole industrial output of the Republic. They will have suffered accordingly from the decline.

One speech forward, two steps back on the conversion road

From the Gorbachev era onward the Government has talked a lot about their determination to "convert" the MIC to make more civilian goods for income and profit[9]. The Soviet MIC made not only war materiel but also nearly all the equipment that the Soviets regarded as "high technology". This included washing machines, TV, cameras, more recently computers and applied electronics. The range was restricted, quality low, design obsolete and indifferent, workmanship poor. They represent poor "value for money". Consequently these goods could only be sold to people who knew no better or who had no other choice. Now they do; the richer people buy products from AICs and the poor from China, Vietnam and the like, mostly brought in by the "shuttlers" - individuals travelling and trading, usually liberally lubricating their passage across frontiers. Their trade is not small: some estimates suggest some billions of dollars. The MIC has no ability to design and make things for a competitive market and as a result they have lost nearly the whole of their market to imports. Much has been written and spoken concerning the conversion of the MIC; see, for example the literature cited in the Endnotes of this paper.

Conversion was another of the slogans to which the Soviet people had become accustomed. The Russians have had several goals for conversion: firstly to turn more of the MIC over to designing and making civilian products. This is even more of a failure than it has been in the West. Secondly to reorganise the MIC along AIC lines, including:

* Linking design, R&D with manufacture. This has always been the case with some sectors of the MIC, especially in aerospace and personal weaponry. Not much progress has been evident elsewhere.

* Concentrating lead factories with subsidiaries to emulate the AIC system of widespread sub-contracting. Again not much movement is evident here; prime contractors still prefer to make many components and articles outside their core competence. This includes making pallets and packing cases.

* Improving their access to finance and presumably to financial skills through Financial-Production Combines. Having in mind the reluctance of Russian banks to invest in their own economy and their absence of investment skills, this is an unpromising road. The union of the MIC with financial institutions on the other hand adds to its political 'networking' and therefore influence within the ruling political and commercial elite.

*Designating lead priority areas which will supposedly receive preferential financing, tax privileges etc. The problem here is exacerbated by the designation of practically every significant sector as a "priority".

The MIC was the best of Soviet industry and the Russian leaders believed that a factory making tanks, aircraft or rocket engines could turn over, due to the "high educational standards of the scientists and engineers and the highly skilled workforce" to making high quality saleable civilian products. A few years later they began to realise that without application on the spot of foreign skills, such as marketing, design etc, they were not going to succeed. Consequently they tried to attract foreign firms to "invest new money and technology in to the old military and other factories". Like so many western ignoramuses about manufacturing industry, they believed that these two ingredients alone would solve their problems and convert their industry into a force capable of competing in the world markets.

The west responded by funding and sending not only employees of the management consulting firms but also engineers and technically and commercially orientated industrialists to work as advisers at the invitation of the governments and general directors of the MIC in Russia and other former soviet countries.

Over the last ten or so years some competent western industrial engineers worked in and visited MIC factories in various industrial sectors. The factories are just that: lacking the normal functions of a commercial firm, based on manufacturing, in an AIC, such as R&D, design, marketing, business planning, technical service to customers, quality assurance, relations with suppliers, a proper financial department. The design bureaux are mostly separate but even when they are contained within the firm as in MiG-MAPO, for example, they lack experience of designing for markets other than the military.[10] When they are ordered or impelled to design civilian products they start without the experience of decades of foreign firms occupied in that business and consequently cannot design products which are competitive. The Russian press has been full of examples of such wasted efforts. Many of their engineers are reported to despise civilian work as a prostitution of their skills.

The aircraft industry is, however, one area which has worked hard at both collaborative and competitive projects with the West. Its several reorganisations have resulted in a slimmed-down, more efficient industry. Even here, however, they can talk glibly of the need for '50-70 different types of aircraft.[11]

Experience shows that the factories are not in a condition to start new production aimed at competing in civilian markets. This is in spite of the fact that the basic stock of machine tools is adequate, some indeed is modern. The problems lie elsewhere, above all in the mentality of managers, engineers and the work force. The buildings allow considerable waste of energy, as does the incorrect use of electrical and other equipment. The layout is poor, there is a paucity of mechanical handling. Very few of these factories would justify foreign investment; it would certainly be more profitable to start again on a green field site, using foreign directors and senior managers,with their own systems for effective control, supervision and management of finances, quality and profit, importing raw materials and components, and the establishment of distribution and after-sales networks.[12]

Of the negative features the most important is the attitude of many of the top level staff who are steeped in a culture which sees the successful methods of the advanced countries as likely to lead to the collapse of the defence industries. Most people in high places in politics, the military and industry as well as the ordinary factory designer and engineer looks with suspicion on advocacy of, for example, reduction in size of design offices, R&D Institutes and of the production factories and also their combination. The idea of closing hopeless units and redirecting their resources to profitable use is anathema. This has been advocated as a shock approach, not in a sensible, gradual manner. Consequently the idea was dismissed out of hand.

Even when a few general directors welcomed and were willing to embrace essential foreign methods, it was clear that there was a reluctance both amongst their juniors and seniors in Ministries of Industry and Defence to allow those changes to take effect.

One must conclude that there are people at every level, especially at the highest level of government, who have no intention of abandoning the old Soviet system, numbers and inflated size of the R&D, design institutes and the factories. This is in the face of

a shrinking of military orders in Russia to 16% of the 1990 totals and the almost complete absence of official finances to support the factories which were, or should have been, almost idle. The civilian output of the factories, which in the last years of the USSR occupied about 40% of their capacity, has also fallen to about 15%, thus the factories are only using 30% of their potential.

By 1996 it was obvious that the Governments concerned wished to re-establish the links between the various units of the MIC which had been snapped by the break up of the USSR in 1991. Admittedly the separation was not conducive to provide even the level of efficiency and effectiveness that prevailed in the Soviet MIC.

An important MIC executive tacitly admitted recently that the definition and purpose of "conversion" had changed since Gorbachev's day when he wrote "Conversion means the production of dual use goods which can easily be adapted from civilian purposes to military and vice versa. That and nothing else."[13]

"Science" as an ikon and as a source of military excellence

Science, along with the Orthodox Church and the Army, forms a triple base which must be supported to regain the Glory of Mother Russia as a Great Power. Expenditure on science, it is said in papers like "Rossiyisskaya Gazeta", not to mention the nationalistic press such as "Zavtra", is essential in order that the people can once again be proud of Russia. The former, for example, is currently running a campaign for Russia to fund a new space shuttle which will "bring back to Russia a new exploration vehicle for the 21st Century. Russia was first into space and with this project will regain its rightful place as the world's leading power in the Cosmos". The paper appeals to ordinary listeners, who, poor deluded fools, are urged to send the paper their savings to fund the project which "the Government and the Fat Cats are too unpatriotic and selfish to support."[14]

In truth, Soviet and present Russian science has done little of note or value except to serve the military. From many sides, not surprisingly including the Academy of Sciences, come pleas to support fundamental science, which is seen as the Glory of Mother Russia as well as its backbone for the future. Fundamental science has been little more than a cloak for long range brain storming and thinking about advanced weaponry. Otherwise it has provided internal relief for academics to write papers whose main value has been publication in learned journals. Association with current scientists is depressing; they seem never to have identified or solved important practical questions. They have been isolated from the world's literature for decades; this, coupled with a lifetime of subjection to propaganda concerning the uniqueness and superiority of Soviet science, leads many of them to claim advances and inventions that "have no analogy in the world".

This would be no worse than in other countries were it not for the absence of the application of good science in the practice of medicine, engineering and agriculture.

The current regime seems quite oblivious to the idea of re-training and redirecting its theoretically orientated people to collaborating with people on the ground, solving their real problems and helping to improve the national economy. Such a policy is treated with contempt in every layer of society. No one is suggesting that it is necessary to commercialise all science, but only a sensible balance between targeted R&D and curiousity led investigations which may or may not yield something useful in the future. One is driven to conclude that there will be no change of heart in this sector either; 'science' will continue to demand financial support from the State and return

very little. It remains a prestige area and an essential in the minds of the rulers and others for the development of Russia as a formidable Power deploying a frightening array of weapons superior to the rest of the world.

Foreign sales of Russian arms

Arms exports are handled by a Government firm 'Rosvooruzheniye'.[15] Its provenance is interesting. In Soviet times arms exports were handled by the enigmatically named engineering directorate of the Ministry of External Trade. After the fall of the USSR this became 'Oboronexport' (defence exports) and the 'Special Technical Directorate' of Spetsvneshtekhnika (special technical exports). These organisations became 'Rosvor'. Rosvor's reporting authority has varied between ministries and the President himself. It served a wide range of powerful interests. Rosvor is almost a monopoly. It is 100% state owned but the arms contractors are represented. It has some subsidiary firms; one 'Promexport' deals with spare parts and service, 'Russian Technology' with licensing of intellectual property. 'Rosvor' answers through the coordinating inter-departmental council whose head was in 1997 Prime Minister Chernomyrdin and his deputy Ya Urinson. Managerial changes will continue.

94% of legal arms exports are reported to pass though its hands; another nine arms manufacturers are entitled to trade abroad on their own account. 'Rosvor', as it ia sometimes described, conveniently means Russian thief. It is often accused of doing just that, taking the proceeds, paying its huge bureaucracy, including serving military officers[16] salaries ten times those paid in the arms factories and R&D offices. Rosvor is credited with paying meticulously its taxes to the Federal Government, thus keeping the top people sweet. Factory directors complain that they get only a small fraction of the proceeds and then very late. Many of them want to bypass Rosvor and some get that authority.

Heads of Rosvor can enrich themselves in anticipation of the sack. Kotelkin, who came from running the MAPO[17] Bank, was appointed in 1994 and was sacked in summer 1997 two days after Yel'tsin had praised him and Rosvor. He had conveniently transferred to a new firm 'Kargotrans' all the assets and business of Rosvor's transportation business. Its director is Yeremichev, Kotelkin's former deputy. It is reported that large sums in dollars have gone to Cyprus.[18]

The Government is relying on foreign arms sales to finance the MIC, to keep it going at its soviet level in the hope of reconstituting the whole soviet MIC by agreements within the CIS. In this way they believe they will be able to rearm the Russian Armed Forces and probably those of Belarus, Ukraine and other CIS states. There has been a recent agreement for the Ukrainian and Russian MIC to cooperate in making and selling in the first instance the large transport plane from Antonov. I have visited their factory in Kiev, with which I was unimpressed.

Analysis of the Russian arms exports however provides little financial basis for optimism. Stripped of elements of sale for barter to third world and other countries such as China, central and Eastern Europe as well as arms provided to some of them in order to extinguish old soviet debts only around $2m/annum is left as a maximum in cash terms. There is no way that such a sum will support the still vast MIC reported above, even if the whole revenue actually reached the factories and is spent correctly.

The largest buyers of Russian arms are the Chinese, with whom Russia is clearly embarked upon a programme of military enlargement. Professor Stephen Blank of the

US Strategic Studies Institute provides a list in Appendix 1 of his paper "The dynamics of Russian weapon sales to China".[19] These purchases, covering air, sea and land systems as well as missiles, amount to well over $6Bn over the last few years. The agreements give the Chinese the right to develop and make some weapons; there are also collaborative development programmes, for example in aero engines. This trade may well grow in the short term but must sooner or later provide diminishing financial returns to Russia. Not all of the weapons supplied have come from the factories, some, such as warships, come from existing kit transferred from the Armed Forces. India is also buying a similar range of equipment. The Russians have recently improved their after sales service, providing depots for technician training, spare parts and manuals in English. Other major targets for Russian arms sales include Malaysia and Indonesia, but much of the purchase price is paid in goods such as food. This barter trade is according to a Russian Finance Minister only "30% efficient in providing real money". The value of return to the factories from all this much heralded trade has to be heavily discounted, especially after deducting the shares taken by the trading companies such as Rosvooruzheniye and the State in taxes.

This region is the main buyer of arms; other countries represent a static or diminshing pattern of purchases. Russian arms are less attractive to them than those of the West. China itself may soon itself be another competitor to Russia. Some modest income might be generated to the defence industries of the CIS from improved collaboration with NATO and the partner countries. In the meantime the finances of the MIC continue to be unpromising.

Conclusion

The Government, says Urinson, now a deputy Prime Minister, owes the MIC 20Bn NR, ($3.33Bn) but the debts of the MIC amount to NR 97Bn. ($16Bn), of which NR 13.3Bn is owed to the Federal Government and the remainder to suppliers as well as fines for non payment of taxes. However the reform, commercialisation and reorganisation of the defence factories is essential to Russia to revive employment and regain a share of its home market with its own manufacture, even if much of that is made under licence[20]. Unlike in the USA or UK, it cannot be allowed to contract into a successful defence industry and liquidate the obsolete rest. It is too significant a part of the whole. With all its defects, it represents the least bad elements of manufacturing industry, upon which the foundation of a profitable, growing indigenous manufacturing sector, both military and civilian, must depend. Unfortunately, there are no signs that the correct policies are understood within Russia or will be put into practice.

The MIC will try to enlarge its sales worldwide, in a shrinking market. It is at last learning techniques of marketing such as providing better after sales service, spare parts centres and supply as well as training of technicians in countries such as India. It will undercut Western suppliers because its prices, as in Soviet times, are unrelated to true costs. The Russians are not reluctant to export even their most advanced weapons, many of which are formidable. They defend the policy at home by arguing that the proceeds provide the only way to fund developments of the next generation of weaponry.

Furthermore, arms sales to Third World countries are always attractive to the rulers, ministers, officials, as well as middlemen. Their prices can much more easily be inflated and justified against outside audit than those of commodities and engineering projects. Consequently there is room to include huge bribes and commissions. Including what is called in the jargon of that trade 'reflux', ie an increased commission

to local representatives, local middlemen and recipients who return part of the sums received to the sellers' agents. As has been well documented, the Russian and fSU selling agencies are far more rapacious and corrupt than even the worst of Western practice. This increases their attraction to many overseas buyers. In this way they provide an increasing competition to Western, including British, arms exports.

In due time, they may well be able to supply modest quantities of very advanced weapon systems to their own armed forces, but to do so they will have to concentrate their funds on a very few R&D, design and manufacturing centres; this goes against the Russian grain. One day the talk of doing so may translate into practice.

Therefore, given the political objective and the will to divert sufficient funds to the job and to retain control of the consequences for the civilian population outside the MIC[21], the MIC will be able more easily to furnish the weapons for a competent Russian combat capable armed force than to transform itself into a competitive source of products and systems to capture a useful share of its own civilian markets or for significant export. This is because it retains its old military understanding and competence but has neither the will nor the competence needed to compete in a harsh economic environment. If an authoritarian Russian government were to be able to restrict imports merely to supply the top people, force the population to buy Russian goods, however bad, and put up with even lower standards of living, then the MIC would live as it did before. In either scenario the MIC remains a threat to Western arms exports, through them to international stability and potentially a direct threat by provision of advanced weapons to its own armed forces.

ENDNOTES

1. Ozhegov, “Conversion and Russia’s regions” paper in FOA symposium, Stockholm Oct 1993.

2. They complain that they are still restricted from buying supercomputers.

3. According to Jacques Sapir, the total was 22 million, but this includes everything from mineral extraction and processing up. Furthermore the MIC totality was engaged roughly on 2/3rds military and 1/3rd civilian production. See his paper in Lit Cit “The Post-Soviet MIC” FOA symposium, Stockholm, October 1993.

4. Svetlana Marzeyeva, Izvestiya, 27.5.96, p5.

5. “Rossiyskaya Gazeta”, 30-12-97, pp1&5 “The order is given to the MIC - Grow!”.

6. According to a deputy Minister of Science and Technology quoted in my NATO paper “The contribution of science and education to the national economy”, 1996.

7. See Lit Cit “Prospects for Russian military R&D”, Sharon L Leiter, RAND, April 1997.

8. See his paper in FOA symposium “The Post Soviet MIC”, 1993 op cit.

9. The Soviets did undertake some conversion even in the 1960s, it produced an automobile complex for example.

10. This is also true of the prime defence contractors in the west, where there has been a lot of reorganisation but little or no “conversion” to civilian products for those reasons.

11. Deputy Minister of the Economy A Svinarenko, quoted by Ye Krivyakina in Finantsovyye Izvestiya, 11 September 1997, p1.

12. See my papers “Rehabilitation of a Russian Military Factory’, CSRC, E63, 1993, and others.

13. Lev Oleynikov, Scientific Research Institute of the Defence Industries. Reported in an interview with “Pravda”, 4 June 1997 pp1&5.

14. See for example the excerpt from “Rossiyskaya Gazeta”, 31.12.97 p13 entitled “We will build a space bridge in 21st Century”.

15. For a detailed but anonymous exposé of the Russian arms trade see Kommersant Weekly No 8 (260), 10 March 1998, p9ff, 'Arms of Selective Destructiveness', and 'Russia and the arms trade', ed Ian Anthony, SIPRI 1998

16. See Segodnya, 29 August 1996, p3, 'The Russian system of arms trading, only the middlemen get rich' by Pavel Felgengauer. This practice is contrary to military law.

17. MAPO is the big aviation complex, now united with MiG and linked with a bank.

18. Rossiyskaya Gazeta, 24 December 1997, 'Who clipped Ruslan's wings?'.

19. Strategic Studies Institute, US Army War College, 1997.

20. See my CSRC paper on rehabilitation of Russian military factories.

21. Currently MIC wages are about 80% of the industrial average, the reverse of Soviet times.