An Estimate of the Value of Chinese Arms Production

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I. Introduction

The economic scope and technological capabilities of China's arms industry have been much discussed in academic and policy circles, in particular since the Chinese government initiated modernization of the arms industry in 1998. Analysis of the Chinese military sector has often been based on estimates and speculation that are not based on open-source data and cannot be easily checked. Specifically, one of the major impediments to an informed debate on trends in the Chinese defence industrial base has been the lack of publicly available information on arms sales and other financial and employment data on the arms industry.[2]

Western analysis of China's military capabilities has been driven, at least in part, by a perceived military threat from China[3] and a desire to understand what the implications of increased production of higher quality weapons by China might be for their own armed forces and export markets. The analysis has been very much focused on specific capabilities, that is, the extent to which China wants to or is able to project military power outside its own territory.[4] However, a lack of empirical data on the value of the industry means there has been little information or analysis on the scope of China's arms production capacity.

The purpose of this research note is two-fold. First, it seeks to draw attention to a broad set of industrial data that may be of use for researchers interested in data on the Chinese arms-producing enterprises. Second, it discusses how these data might be used to make a rough estimate of the magnitude of Chinese arms sales, and to cross-check information provided by the Chinese government. A table of company revenues is presented, drawn entirely from open-source information translated from Chinese. While it has not been possible to check the reliability and comprehensiveness of these figures, it is hoped that by making them broadly available, their credibility and implications can be discussed, and that this will contribute to informed debate and assist researchers and policy makers to understand the changes taking place in the Chinese arms industry. These changes, as well as the increased availability of information, should be seen both

[1] The author is grateful to Elisabeth Sköns, Bates Gill and Tai Ming Cheung, who commented on draft versions of this research note. Any errors, omissions or miscalculations remain my own.

[2] For the most comprehensive study in recent years see Medeiros, E., et al., *A New Direction for China's Defense Industry* (RAND: Santa Monica, 2005), URL <http://www.rand.org/pubs/monographs/2005/RAND_MG334.pdf>. The study also includes an extensive bibliography. SIPRI studies on the Chinese arms industry include Eric Arnett, 'Military technology: the case of China', *SIPRI Yearbook 1995: Armaments, Disarmament and International Security,* (Oxford: Oxford University Press, 1995), and Frankenstein, J., 'The People's Republic of China: Arms production, industrial strategy and problems of history', in Wulf, H., *Arms Industry Limited*, SIPRI (Oxford: Oxford University Press, 1993). See also the China studies in Arnett, E. (ed.) *Military Capacity and the Risk of War: China, India, Pakistan and Iran,* SIPRI (Oxford: Oxford University Press, 1997).

[3] 'Peaceful rise: even when China is trying hard to be conciliatory, it scares its neighbours', *Economist,* 24 June 2004, URL <http://www.economist.com/world/asia/displayStory.cfm?story_id=2792533/>.

[4] E.g. the RAND report (Medeiros, note 1), argues that China's increasingly advanced weapons may be 'relevant to a possible conflict over Taiwan but also to China's long-term military presence in Asia'. There has also been considerable interest in China's arms exports to the developing world.

in the context of the unprecedented expansion of the Chinese economy and the transition from a planned to a market economy.

II. Background

In order to set the context for the increase in the amount of available data it is useful to provide a brief background on the development of the Chinese arms industry in recent years.

Analysts have long speculated that the Chinese military–industrial base was beset with inefficiencies.[5] Military technologies were considered to be several generations behind those of the Western powers. Weapons produced domestically were not delivered on time to the People's Liberation Army (PLA), and they were defective or of poor quality.[6]

However, a recent study by the RAND Corporation concludes that it is time to reevaluate this assessment.[7] It argues that the Chinese arms industry is no longer as backward as was once widely thought. The quality of arms produced in China has increased markedly in recent years and there are specific 'pockets of excellence' in some industry sectors, for example in missile production.

The historical problems in the Chinese military–industrial base were related both to technological capabilities and to policy. The capabilities problem is to an extent being addressed by China's rapid economic growth and the flow of economic investment and technical expertise into the country, although China still remains a long way behind the advanced Western powers in terms of military technology and capabilities. In 1998 the Chinese government addressed the policy problem of procuring arms in a timely and efficient manner by bringing under civilian control the formerly military-controlled Commission on Science Technology and Industry for National Defense (COSTIND) and establishing the General Armaments Department (GAD), which took on the duties of military procurement.[8]

Another highly significant change in the Chinese arms industry was the July 1999 reorganization of China's five arms companies into ten 'enterprise groups'. An eleventh enterprise group (for defence electronics) was added in 2002.[9] These groups are effectively holding companies and are often referred to as 'group corporations'. They have under their control many major companies that produce both civil and military goods for the domestic and international markets. The idea behind the reorganization was to introduce a level of commercialization by encouraging competition between the companies and increasing their accountability for financial losses.[10] This restructuring

[5] According to a comprehensive review of the scholarship by Bates Gill, 'Probably the single most consistent theme in the literature of Chinese military–technical development stresses the *problems* that China faces, rather than the accomplishments it has achieved'. See Bates G., 'Chinese military–technical development: the record for Western assessments, 1979–1999', in Mulvenon, J. C., and Yang, A. N. D. eds, *Seeking Truth from Facts: A Retrospective on Chinese Military Studies in the Post-Mao Era* (RAND Corporation: Santa Monica, CA, 2001).

[6] Medeiros (note 1), p. 33.

[7] Medeiros (note 1), p. iii

[8] Medeiros (note 1), p. xx,

[9] Medeiros (note 1), p. xix

[10] The Chinese arms industry 'broke even' in 2002 after eight consecutive years of losses. See 'China's defence industry breaks even in 2002', *People's Daily*, 9 Jan., 2003, URL <http://english.people.com.cn/200301/09/eng20030109_109791.shtml>

of the military–industrial base had important implications for the defence industrial base but must be understood in the context of the broad economic reforms in China. The next section provides some historical and contextual background, which is necessary to understand why there have been difficulties in obtaining reliable data on arms production in China.

III. Transparency in Chinese arms production

China's centralized Soviet-inspired model of arms production, apart from providing a lack of incentive for efficiency and innovation, also made it difficult for researchers to gather information about the Chinese arms industry during the cold war. There was a high level of military secrecy in several countries, among them China, which lacked confidence in its military strength and feared invasion. The 'machine building industries', in which arms production took place, reported to different government ministries (which often had overlapping responsibilities)[11] and these data were not made publicly available.

In the rest of the world arms production now takes place mainly within privately held or publicly listed companies.[12] Shareholder owned companies in particular are compelled to provide extensive financial information about their activities, both to their shareholders and to regulatory authorities. Most of the companies are involved in civil as well as arms production, but the disclosure of these data sheds light on both sides of their business.[13] This is not to say that the level of transparency among Western arms-producing companies is satisfactory, as in many cases it remains far from acceptable,[14] but the privatization of arms production has resulted in more data for researchers to analyze.

The entire arms industry in China, by contrast was—and remains—effectively state owned. In recent years some private companies in China have started to produce military equipment on a small scale, although this development is at the very early stages.[15] Thus, during the cold war, the picture of arms production was much clearer in Western Europe and the USA than it was in China. In the absence of data on arms production provided by national governments, researchers were able to look at the sales

[11] Medeiros (note 1), p. 14,

[12] Notable exceptions are Russia, India and Israel. A significant part of the arms industry in France is also state owned.

[13] There are several different criteria on which transparency can be assessed, including availability (ease of access, timeliness and clarity of presentation); reliability (quality of information); comprehensiveness (type and quantity); comparability (over time and between countries, requiring consistent methodologies); disaggregation (level of detail of information); and relevance (relevance of data to stated purpose). See Surry, E., *Transparency in the Arms Industry*. SIPRI Policy Paper No. 12 (SIPRI: Stockholm, Jan. 2006), URL <http://www.sipri.org/contents/publications/Policypaper12.pdf/download/>.

[14] Surry, E., *Transparency in the Arms Industry*. SIPRI Policy Paper No. 12 (SIPRI: Stockholm, Jan. 2006), URL <http://www.sipri.org/contents/publications/Policypaper12.pdf/download/>.

[15] 'China should introduce private firms to manufacture arms, expert', Chinanews.cn, 15 Sep. 2006, URL <http://www.chinanews.cn/news/2005/2006-09-15/27707.html>. The author interviewed the source for this article (Jiang Luming, Director of the National Defense Economic Research Center, China National Defense University), 30 Oct. 2006, and confirmed that this trend is still in the very early stages. It should also be noted that, while some of China's defense production companies have commercialized (and in some cases have listed these ostensibly civil production entities on stock exchanges in China and Hong Kong), the military production side of these enterprises remains under state-ownership. Some financial data can be gleaned from open sources about the civilian parts of formerly purely military–industrial enterprises, but it cannot be determined if any of the capital being raised by these public offerings is being used on the military side of the business.

of the major arms-producing companies in each country as a 'next-best' option. This was not the case with the state-owned industry in China; in fact, it has been the only country to be specifically excluded from the SIPRI list of top 100 arms-producing companies due to the lack of comparable data.

The Chinese government has improved its level of transparency in recent years, in particular through the publication of a series of defence white papers. The Commission of Science and Technology and Industry for National Defence (COSTIND) now provides much interesting information on their website. A noteworthy piece of information they produce is an annual value of total civilian output from the arms industry.[16] But these data are difficult for researchers to independently verify because disaggregated information is not supplied.

China acceded to the World Trade Organization (WTO) in December 2001. As a consequence, it made 'commitments to open and liberalize its (economic) regime in order to better integrate in the world economy and offer a more predictable environment for trade and foreign investment in accordance with WTO rules'.[17] This has resulted in increased transparency and openness not only by the Chinese government, but also by companies seeking to attract investment from overseas. The companies are increasingly adapting to Western market practices by listing on stock exchanges and reporting financial data, including their revenues and profits.[18] Thus, the availability of general industrial information has improved in recent years. This research note proposes an alternative way to make an estimate of the annual value of Chinese arms production – by looking at this 'supply-side' (using industry data), instead of focusing only on the 'demand-side' (using government data).

The list of top 500 enterprises in China

The China Enterprise Confederation/China Enterprise Directors Association (CEC-CEDA) has 436 000 members, including companies, individual employers and industry associations.[19] Since 2002 they have been compiling data on Chinese companies and producing a list of the 'top 500 enterprises in China'. The list ranks companies by their total revenues, and also includes data on profit, taxes and employment. The companies themselves submitted the data.[20]

The list is apparently modeled, at the initiative of the CEC-CEDA Director, on the Fortune 500.[21] It is produced only in Chinese and can only be purchased in book form

[16] These data will be further discussed in section V.

[17] World Trade Organization (WTO) 'WTO successfully concludes negotiations on China's entry', Press release, URL <http://www.wto.org/English/news_e/pres01_e/pr243_e.htm>.

[18] The 11 defence enterprises all have websites and publish a variety of information about themselves including contract awards, product information, employment data and other general press releases. Increasingly they are seeking to attract overseas investment and form industrial partnerships, and this may also be a reason for the growth in published information. The companies are now more confident in their ability to compete on the world market and they want to promote their products. It is worth noting that developments in information technology can assist non-Chinese speaking researchers who want to find out more about the companies. Advancements in auto-translation services provided by various websites opens up a wealth of information that was only available to Chinese speakers just a few years ago. These make it possible for non-Chinese speaking researchers to identify possible webpages of interest before deciding whether to obtain full translations.

[19] For more information about CEC-CEDA, visit URL <http://www.cec ceda.org.cn/english/organization/index.html>.

[20] Zhao, H., Project Manager of CEC-CEDA, Interview by the author, 31 Oct. 2006, in Beijing.

[21] See the 2006 Fortune 500 list at URL <http://money.cnn.com/magazines/fortune/fortune500/full_list/>.

direct from the association (although selected data has been reproduced by Chinese newspapers in their reporting about the book) The list contains information on companies from many sectors of the Chinese economy. In 2006 the 500 companies on the list accounted for 78 per cent of China's GDP.[22]

This data set, although intended primarily to be of interest to a wider audience, can also contribute to our understanding of the size of the Chinese arms industry. The reorganization of the Chinese military sector has, as mentioned above, resulted in 11 distinct holding companies that now make up the bulk of the military–industrial base. Most of these companies appear in various years on the top 500 lists (table 1). This provides an insight into their economic activities to an extent that would have been unthinkable just a decade ago. Combined with increased transparency regarding military production by the Chinese government, it means that researchers can get a rough picture of how the industry looks.

Table 1 lists the publicly available information on total sales by the 11 defence enterprises from the CEC-CEDA top 500 list. The reasons for the 'blanks' are unknown. Since one of the nuclear enterprises submitted information, it can be reasoned that military secrecy is not the main factor behind the non-reporting. One possible reason of many might be that companies did not submit data because they were not aware of the list. The 'blanks' in the data that can be filled with rough estimates, however. The next section explains the methodology that has been employed in this research note to make those estimates.

IV. A provisional estimate of the military output of the Chinese arms industry

The companies that make up the 11 defence enterprises produce civil as well as military goods, and the difficulties in estimating what percentage of each company's sales is military remain. But increasing transparency on the part of the Chinese government can shed some light at least on the magnitude of the value of total national arms production, since the clear bulk of this takes place within these 11 companies. Since 1998 China has published five defence White Papers. The following item of interest was published in the 2004 version: 'In 2003, the output value of civilian products rose by 20 per cent as compared with that of the previous year, accounting for more than 65 per cent of the total output value of the defense-related science, technology and industry.'[23] By implication, the military share of total output was up to 35 per cent.

This information was of limited value as long as the revenues or value of production of the defence enterprises were not generally known. But by combining the CEC-CEDA data on total company sales with the information on the military share of the industry in 2003 that was provided in China's 2004 Defence White Paper, a very rough estimate of total Chinese military output can be derived for that year. The 'blanks' in the data set are problematic, however, and require estimates to be made of the total sales for some companies for 2003.

[22] 'Top 500 Enterprises 2006 account for 78 percent of China's GDP', *People's Daily,* Sep. 2 2006, URL <http://english.people.com.cn/200609/02/eng20060902_299101.html>.

[23] 'White Paper on National Defense Published', China.org.cn, URL <http://www.china.org.cn/english/2004/Dec/116032.htm>.

While there are always definitional problems with the classification of 'military' and 'civil', it is known that parts of the military–industrial base are used for the production of buses, automobiles, and motorcycles for civilian use. These companies are responsible for manufacturing many of the vehicles on China's roads today.[24]

Table 2 shows the total sales for 10 of the 11 Chinese defence companies in 2003 (in local currency, at current prices), including estimates for the five enterprise groups for which no data was available in that year. These estimates have been made based on the following assumptions. If it is assumed that the trend in total sales of China Aviation Industry Corporations (AVIC) I and II is the same as for the five companies for which the sales are known for both 2002 and 2003, this means that their sales increased by 29 per cent between these two years. Applying this change to the total sales for 2002 produces an estimate of 2003 total sales of 46,659 million yuan for China Aviation Industry Corporation I and 33,982 million yuan for China Aviation Industry Corporation II (table 2).[25]

For China Aerospace Science and Industry Corporation, the same approach was not used since it produced an unrealistic figure—one that exceeded that of the next known year (such a result is possible but unlikely). Instead, the average figure for 2002 and 2004 of 25,453 million yuan was used for the year 2003.

The other three companies for which data on total sales are missing for 2003 are China Nuclear Engineering and Construction Corporation, China Aerospace Science and Technology Corporation and China Electronics Technology Group Corporation. While there is no basis for making an estimate of total sales for the third of these companies, some rough estimates have been produced for the first two, based on how they were created during the restructuring of the Chinese arms industry in 1999.

When China's five core arms-producing entities were split into 10, the idea was that each should be divided into two roughly equivalent groups.[26] They were expected to compete against each other for production contracts, so each of the 'new' companies was intended to have approximately equal resources and capacities. This competitive spur did not have exactly the anticipated results and some of the new 10 enterprises, in particular AVIC I and AVIC II, by 2006 do have quite different capabilities and production focuses.

China Aerospace Science and Technology Corporation and China Aerospace Science and Industry Corporation were created 'by dividing into two parts a single state-owned corporation, the China Aerospace Corporation'.[27] While data for the former is missing, there is data for most years for the latter. In order to be able to include the sales of both these companies in the estimate of total Chinese arms sales, it is therefore assumed that the sales of the former can be used as a very rough approximation for the sales of China Aerospace Science and Technology Corporation. This is particularly problematic,

[24] The website of AVIC II, for example, claims that the company holds 40% of the Chinese mini-van market. See URL < http://www.avic2.com/JiTuanJJ/erji_jj.htm>.

[25] It is interesting to note that, if these estimates had been averaged against estimates made backwards for China Aviation Industry Corporations I and II (using information on increases between 2003 and 2004 or 2003 and 2005, respectively, for companies for which figures are available), the results would have been roughly the same.

[26] 'Ten Military Industry Corporations Are Founded,' Zhongguo hangtian (China Aerospace), August 1999, as translated in FBIS, August 1, 1999. The article was referred to in *A New Direction for China's Defense Industry*, on p 68.

[27] Medeiros (note 1), p. 53.

however, because it cannot be known for certain that the companies evolved in the same way and at the same speed.

The estimate of total sales for China Nuclear Engineering and Construction Corporation (CNECC) is produced according to the same logic: The CEC-CEDA data on the other nuclear enterprise, China National Nuclear Corporation, is a full series of data for 2001–2005. These figures have thus been taken as a very rough estimate for the total sales of CNECC.

The only defence enterprise for which no estimates at all could be made is China Electronics Technology Group Corporation. This group was established in late 2002, three years after the formation of the 10 other military–industrial groups. Estimating the civil/military split may be particularly difficult with this eleventh enterprise because a high proportion of the products are likely to be dual-use in nature. This problem of definition is not specific to electronics. There may also be a relatively high percentage of civilian end-use work done by ordnance production companies (such as explosives for the mining industry) and military vehicle production companies (such as heavy trucks). As noted in the senate testimony of Chinese arms industry expert Evan Medeiros (discussed later in this section), the shares of civilian and military production will vary quite widely between the ten enterprises. The figure of more than 65 per cent for civilian output provided in the Chinese white paper is, it should be noted again, an average for the total Chinese arms industry.

Due to the numerous analytical and statistical uncertainties surrounding these data, it is most realistic to provide in this research note a possible range for the value of Chinese arms production, rather than an exact number. There are different ways in which this could be done. Based on the assumptions described here, we arrive at an estimate of the total sales in 2003 for 10 of the 11 defence enterprises (all except China Electronics Technology Group Corporation) of 314,957 million yuan. As it is known that the bulk of Chinese military production is performed by these 10 companies, and since we know from the previously cited information in the defence white paper that military output accounted for up to 35 per cent of the total sales of the Chinese arms industry in 2003, this percentage can be used to estimate the 'maximum' value of the military output of the Chinese arms industry as being approximately 110 billion yuan.

To produce a 'low-range' estimate, if we assume an 80 per cent civilian share instead of a 65 per cent civilian share, the figure would be approximately 63 billion yuan. There is some evidence to support this. The exact wording of the white paper indicates a civil share of "*more than* 65 per cent". Using a higher number than 65 per cent is also supported by the testimony of Evan Medeiros to the US–China Economic and Security Review Commission in 2004, according to which 'current estimates of the amount of civilian production in each of the 11 large defence corporations ranges from 65 per cent to 90 per cent depending on the particular firm.' [28] Unlike the figure from the white paper this is not an estimate for the total industry, but a figure of 80 per cent seems a reasonable average to apply to produce a 'low-range' estimate. Thus, if the assumptions on which the estimates above have been made are accepted, this implies that in 2003 the value of the military output (for 10 of the 11 major arms-producing group corporations

[28] Medeiros, E., 'Analyzing China's defense industries and the implications for Chinese military modernization', Presentation to the US–China Economic and Security Review Commission on Feb. 6, 2004, URL <http://www.rand.org/pubs/testimonies/2005/RAND_CT217.pdf>.

that make up the majority of the Chinese arms industry) would be in the range of 63-110 billion yuan.

There are many methodological problems with converting the yuan to other currencies. [29] If the official market exchange rate for 2003 of 8.277 yuan/US dollar is applied, then this range would correspond to a dollar range of $7.6-13.3 billion for the value of military output of the Chinese arms industry in 2003.

V. An assessment of the realism of this estimate

In assessing whether the estimates arrived at in this research note are realistic, four main problems must be kept in mind: (1) The reliability of the CEC-CEDA data, (2) the reliability of the military / civilian output share estimates, (3) the realism in the assumptions made for making the estimates of total sales for 5 of the 10 companies, and (4) the extent to which the estimated range in this research note is in keeping with what we already know about the Chinese military sector and its place in the world. This last point requires some contextualization by comparison with other available data.

Regarding the reliability of the CEC-CEDA data, more data work is needed and more research is required. The data set is a relatively new one, which may detract from its reliability. The government is not the source of these data and it is intended primarily for people who are interested in other aspects of the Chinese economy. Because the companies themselves submit the data, it is also not out of the question that they could report inflated results. There is also the possibility that the methodologies used to produce the estimates made in table 2 have resulted in figures that are too high, or that data are in the tables have been missed or misinterpreted.

Regarding the reliability of the military / civilian output share: Chinese estimates of the civilian output of its military industry have been criticized in the past for being over-optimistic and have even been characterized as “tall claims”.[30] A March 1994 People’s Daily article asserted that civilian output had increased from 8.1 per cent in 1978 to 77.4 per cent in 1993.[31] But, as one analyst noted in 1994, defence conversion in China “has been obfuscated in a barrage of repetitive, sometimes contradictory, announcements as well as undocumented, unverifiable, statistics”.[32] The possibility must be acknowledged that this new official white paper figure of ‘more than 65 per cent’, while it has become increasingly plausible, may still be too high.

In terms of the realism of making estimates for 5 of the 10 companies, this is certainly the most problematic part of the calculations. There are two ways of assessing these estimates. First, by assessing the calculations by which they are derived. Second, by

[29] See Ward, M., ‘International comparisons of military expenditures: issues and challenges of using purchasing power parities’, SIPRI Yearbook 2006 (Oxford University Press: Oxford, 2006), pp. 369-386.

[30] For a detailed discussion see Mohanty, D., ‘Defence industry conversion in China: problems and prospects’, Strategic Analysis, vol. 14, no. 2 (May 2000), URL <http://www.ciaonet.org/olj/sa/sa_may00mod01.html>. On the mixed results of Chinese conversion, see section VI of Frankenstein (note 1), Wulf, H., ed. *Arms Industry Limited*, SIPRI (Oxford University Press: Oxford, 1993). It should be noted also that the motivations for conversion may not always be benign: ‘for China, conversion is not only intended to reduce the quantity of military production or—as is often proclaimed by the leadership—to contribute to world peace; it is also a policy to modernize the Chinese military–industrial base through imports of modern technology’. ‘Arms production’, *SIPRI Yearbook 1992* (Oxford University Press: Oxford, 1992), p. 370.

[31] Cited in Mohanty (note **x**).

[32] Blasko, D.J., 'An introduction to the Chinese defense industry', 22 Jan. 1994, GlobalSecurity.org, URL <http://www.globalsecurity.org/military/library/report/1994/940122-pladef.htm>

cross-checking their magnitude by making a similar calculation for another year. The two estimates which are based on the assumption that the split of two of the core arms-producing entities produced companies of equal size are associated with an unknown margin of error. Further information is required to assess the realism of this assumption. For the other three estimates, the margin of error may not be large, first because there is data for most of the period, and second since they are based either on the assumption that their sales moved at the same rate as those companies for which data are available, or on an even growth rate between 2002 and 2004. The second way of assessing the estimate was done by making a similar exercise for estimating the military output of the 10 companies for 2002, by applying the same civilian/military share as in 2003. This produced a result which was not radically different from the figure for 2003.

Finally, the estimate provided in this research note can be cross-checked against the Chinese government's own data. Information provided by COSTIND states that the civilian output of the Chinese arms industry in 2003 was 106.4 billion yuan.[33] This data is not possible to check independently because it is not accompanied by disaggregated supporting documentation. The 65/35 civilian-military ratio from the White Paper could be used, however, to ascertain a total output of the Chinese arms industry (civilian as well as military) of 164 billion yuan. This compares to the total output produced by the methodology in this research note of 315 billion yuan.

Thus, there is a clear discrepancy here between the results achieved using 'supply-side' (industry) and 'demand-side' (government) data. There are two possible reasons for this. The first is that companies are reporting inflated revenues to CEC-CEDA, and / or that the estimates made in this research note are too high. The second possibility is that the civil share is substantially lower than officially stated. If it is assumed, for example, that the estimate of total sales in 2003 for ten of the eleven defence enterprises (314.9 billion yuan) is correct, *and* if the COSTIND figure of 106.4 billion yuan is accurate, this would indicate that the civil share would in fact have been as low as 34 per cent in 2003. An accurate value of Chinese arms production most likely lies somewhere in the middle of these two possibilities, but we do not know with any certainty.

A significant proportion of the Chinese defence industrial base could be described as dual-use and this may account for some of the questions raised here. It may be the case, particularly with electronics, that a "large proportion of electronic products can be immediately sold in the civilian market without having to significantly alter the product itself".[34] The same is true of explosives. If the products are essentially the same but the customers are different, an interesting discussion could be had on the success of

[33] 'China unveils civilian exports using military technology', *People's Daily Online,* 11 Dec. 2003, URL <http://english.people.com.cn/200312/11/eng20031211_130142.shtml> A figure for the value of civilian output has been given by COSTIND for the past several years and reported on by Chinese media. In 2004 it was 165.6 billion yuan. Wang Yu, "China's Military Industry Sector Realized Rapid Growth of Over 20 Percent in 2004", *Xinhua Domestic Service, FBIS Translated Text*, 24 Jan. 2005. In 2005 it was 195 billion yuan. 'China's defense industry reports two-digit growth in revenues, profits last year', *People's Daily Online,* 6 Jan. 2006, URL <http://english.people.com.cn/200601/06/eng20060106_233289.html> In 2006 the figure was 260.74 billion yuan. The COSTIND press release with this information for 2006 (dated 2 Feb. 2007) can be viewed at URL <http://www.costind.gov.cn/n435777/n435779/n435927/91602.html>.

[34] Blasko, D.J., 'An introduction to the Chinese defense industry', 22 Jan. 1994, GlobalSecurity.org, URL <http://www.globalsecurity.org/military/library/report/1994/940122-pladef.htm>

'conversion' in China. This would be easier if the Chinese government were to develop even further the steps they have already taken regarding transparency. They could clarify these discrepancies by supplying more disaggregated data on the total output of their defence industrial base (not just the civilian output), including information on the military-civil ratio (and details of the definitions they have applied).

To put the estimated range made in this research note into some context, some comparisons can be made with another major arms-producing company, France. The French arms industry had arms sales of $14.6 billion in 2002, [35] which means that the estimate made here for a military output of $7.6 billion - $13.3 billion by the Chinese arms industry in 2003 corresponds to 52-91 per cent of the arms sales of the French arms industry.

A comparison of the ratio between military sales and military expenditure can also be made. The estimated range for China's 2003 military ouput would correspond to 22-39 per cent of the SIPRI estimate of their 2003 military expenditure ($34.2 billion), while that ratio was about 32 per cent for France (which had a military expenditure of $45.9 billion in 2003).[36]

A final comparison that can be made to provide some context to the estimated range of $7.6 billion - $13.3 billion is a comparison with the arms sales of the major arms producing companies in the world. The top three arms-producing companies in 2003 each had arms sales ranging from $23-25 billion, a level twice as high as the high-range estimate for the military output of the entire Chinese arms industry.

V. Conclusions

China still lags behind the rest of the world in terms of transparency, but is catching up fast. The gradual transition to a market economy has resulted in Chinese economic enterprises behaving in ways that facilitate comparison (for example by making more economic data publicly available). As shown in the data provided here, this is true also for companies engaged in military production. More research is needed to increase our understanding of arms production in China, but the information required to facilitate analysis is becoming increasingly available in the public sphere.

The data and estimates presented in this paper raise many questions, and are intended to stimulate further discussion, analysis and data retrieval. It is hoped that other researchers, particularly in China, can assist with filling in the 'blanks' in our collective knowledge of this issue. To facilitate this, it is hoped that Chinese defence white papers will continue to provide similar information.[37]

[35] Délégation Générale pour l'armement, La DGA en chiffres / Les programmes d'armement en 2003 (Annexes), URL <http://www.defense.gouv.fr/dga/content/download/43550/435065/file/annexes_ra_partie4_2003.pdf>, p. 43.

[36] Sköns, E., Perdomo, C., Perlo-Freeman, S. and Stålenheim, P. 'Military expenditure', SIPRI Yearbook 2004 (Oxford University Press: Oxford, 2004).

[37] The most recent was published in 2006. See "China's National Defence in 2006" URL <http://www.chinadaily.com.cn/china/2006-12/29/content_771191.htm. However, it did not provide a breakdown of civil-military output of the kind supplied in the 2004 white paper.

Table 1. Data on total sales for the 11 defence enterprise groups in China.

Figures are in local currency.
"-" indicates that data are not available or have not yet been located.

Company Name in English	Company Name in Chinese	2001 total sales	2002 total sales	2003 total sales	2004 total sales	2005 total sales
China National Nuclear Corporation	中国核工业集团公司	¥8,474,810,000	¥9,657,140,000	¥13,198,500,000	¥17,329,630,000	¥18,915,830,000
China Nuclear Engineering and Construction Corporation	中国核工业建设集团公司	-	-	-	-	-
China Aerospace Science and Technology Corporation	中国航天科技集团公司	-	-	-	-	-
China Aerospace Science and Industry Corporation	中国航天科工集团公司	¥13,366,000,000	¥22,671,110,000	-	¥28,235,040,000	¥34,005,480,000
China Aviation Industry Corporation I	中国航空工业第一集团公司	¥24,501,570,000	¥36,111,110,000	-	¥58,058,010,000	¥69,989,200,000
China Aviation Industry Corporation II	中国航空工业第二集团公司	¥21,207,140,000	¥26,300,000,000	-	-	¥41,109,970,000
China State Shipbuilding Corporation	中国船舶工业集团公司	¥16,674,370,000	¥19,715,230,000	¥25,533,610,000	-	-
China Shipbuilding Industry Corporation	中国船舶重工集团公司	¥17,711,550,000	¥20,048,180,000	¥29,139,450,000	¥41,936,680,000	¥49,641,140,000
China North Industries Group Corporation	中国兵器工业集团公司	¥35,571,000,000	¥42,614,710,000	¥52,180,340,000	¥64,060,920,000	¥79,411,280,000
China South Industries Group Corporation	中国兵器装备集团公司	¥25,084,820,000	¥39,692,180,000	¥50,159,090,000	¥64,354,750,000	¥75,222,030,000
China Electronics Technology Group Corporation	中国电子科技集团公司	-	-	-	-	-

Sources:

Sales data are collected and published by the China Enterprise Confederation / China Enterprise Directors Association (CEC / CEDA).
The data appear in the annual CEC / CEDA "Report on the Development of Chinese Enterprises"
The report is not published online and is available for sale direct from CEC / CEDA at http://www.cec-ceda.org.cn/english/guanggao01.html
The following links are to Chinese media websites that have reproduced all or part of the "Top 500" table in their reporting.
The links are provided to assist researchers to check the figures in this table. It is also hoped that they might also be able to assist in locating more data.)

2006 list (with data for 2005): http://finance.people.com.cn/GB/1039/4773783.html. Note that the website only reproduces the first 100 companies.
2005 list (with data for 2004): http://finance.people.com.cn/GB/1037/3634303.html. Follow the links at the bottom of the page to get the other 400 companies.
2004 list (with data for 2003): http://www.cq.xinhuanet.com/subject/2004/500qiang/
2003 list (with data for 2002): http://www.cq.xinhuanet.com/subject/2004/500qiang/2003qy500q.doc
2002 list (with data for 2001): http://www.cq.xinhuanet.com/subject/2004/500qiang/2002qy500q.doc

Table 2. An estimate of the magnitude of the Chinese arms industry.

Figures are in local currency.
"-" indicates that data are not available or have not yet been located.
"est." indicates that an estimate has been made; see the research note for details of how these estimates have been calculated.

Company Name in English	Company Name in Chinese	2001 total sales	2002 total sales	2003 total sales	2004 total sales	2005 total sales
China National Nuclear Corporation	中国核工业集团公司	¥8,474,810,000	¥9,657,140,000	¥13,198,500,000	¥17,329,630,000	¥18,915,830,000
China Nuclear Engineering and Construction Corporation	中国核工业建设集团公司	¥8,474,810,000 est.	¥9,657,140,000 est.	¥13,198,500,000 est.	-	-
China Aerospace Science and Technology Corporation	中国航天科技集团公司	¥13,366,000,000 est.	¥22,671,110,000 est.	¥25,453,070,000 est.	-	-
China Aerospace Science and Industry Corporation	中国航天科工集团公司	¥13,366,000,000	¥22,671,110,000	¥25,453,070,000 est.	¥28,235,040,000	¥34,005,480,000
China Aviation Industry Corporation I	中国航空工业第一集团公司	¥24,501,570,000	¥36,111,110,000	¥46,659,165,231 est.	¥58,058,010,000	¥69,989,200,000
China Aviation Industry Corporation II	中国航空工业第二集团公司	¥21,207,140,000	¥26,300,000,000	¥33,982,230,000 est.	-	¥41,109,970,000
China State Shipbuilding Corporation	中国船舶工业集团公司	¥16,674,370,000	¥19,715,230,000	¥25,533,610,000	-	-
China Shipbuilding Industry Corporation	中国船舶重工集团公司	¥17,711,550,000	¥20,048,180,000	¥29,139,450,000	¥41,936,680,000	¥49,641,140,000
China North Industries Group Corporation	中国兵器工业集团公司	¥35,571,000,000	¥42,614,710,000	¥52,180,340,000	¥64,060,920,000	¥79,411,280,000
China South Industries Group Corporation	中国兵器装备集团公司	¥25,084,820,000	¥39,692,180,000	¥50,159,090,000	¥64,354,750,000	¥75,222,030,000
China Electronics Technology Group Corporation	中国电子科技集团公司	-	-	-	-	-

2003 Total (for 10 companies):	¥ 314,957,025,231
2003 "high-range" arms share: (see note 1)	35 %
2003 "high-range" estimated arms sales for 10 of the 11 defence enterprises in China:	¥ 110,234,958,830
2003 "low range" arms share: (see note 2)	20 %
2003 "low-range" estimated arms sales for 10 of the 11 defence enterprises in China:	¥ 62,991,405,046

Sources:

Sales data are collected and published by the China Enterprise Confederation / China Enterprise Directors Association (CEC / CEDA).
The data appear in the annual CEC / CEDA "Report on the Development of Chinese Enterprises"
The report is not published online and is available for sale direct from CEC / CEDA at http://www.cec-ceda.org.cn/english/guanggao01.html
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2005 list (with data for 2004): http://finance.people.com.cn/GB/1037/3634303.html. Follow the links at the bottom of the page to view data for the other 400 companies.
2004 list (with data for 2003): http://www.cq.xinhuanet.com/subject/2004/500qiang/
2003 list (with data for 2002): http://www.cq.xinhuanet.com/subject/2004/500qiang/2003qy500q.doc
2002 list (with data for 2001): http://www.cq.xinhuanet.com/subject/2004/500qiang/2002qy500q.doc

(1) "China has made remarkable progress in putting military industrial technology to civil use in the past two years. In 2003, the output value of civilian products rose by 20% as compared with that of the previous year, accounting for more than 65% of the total output value of the defense-related science, technology and industry." http://www.china.org.cn/english/2004/Dec/116032.htm#8
(2) See the testimony of Chinese arms industry expert Evan Medeiros to the US–China Economic and Security Review Commission in 2004, according to which "current estimates of the amount of civilian production in each of the 11 large defence corporations ranges from 65 per cent to 90 per cent depending on the particular firm.' Medeiros, E., 'Analyzing China's defense industries and the implications for Chinese military modernization", Presentation to the US–China Economic and Security Review Commission on Feb. 6, 2004, URL <http://www.rand.org/pubs/testimonies/2005/RAND_CT217.pdf>.