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The end of a military-industrial triangle: arms-industrial co-operation between China, Russia and Ukraine after the Crimea crisis

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Abstract: Due to a U.S./EU arms embargo that was imposed on China in 1989, China remains excluded from trading with any of the leading arms producers except for Russia and Ukraine. The previously existing military-industrial symbiosis between Ukraine and Russia, however, came to an abrupt end in 2014 with Russia’s invasion and resulting occupation of Crimea. The sudden breaking off of defense-industrial ties between these two closely interwoven military-industrial complexes offers analysts the unusual chance to study the nature of transnational arms production arrangements and their strategic implications under crisis conditions. China is poised to benefit from this, while Western sanctions create incentives for China and Russia to enhance their mutual strategic co-operation.

Keywords: Russia, Ukraine, China, military-industrial cooperation, arms transfers, Crimea-Crisis

1 Introduction

Large-scale co-operative arms production typically takes place within the framework of strategic long-term alliances that are formed between key military-industrial players (often state-owned or partly state-owned enterprises in technologically advanced countries); the national governments that back them; and procurement agencies within customer countries that aim to achieve military-technological progress. These alliances are in many cases embedded within a system of large-scale strategic government-to-government exchanges. They can be part of a much wider framework involving civilian technology transfers, e.g. nuclear power plants, civilian transport infrastructures or other types of projects, and typically demand so-called „offsets” from the supplier country that are not necessarily related to arms production. In some cases they give rise to durable infrastructures for maintenance or training that are operated by personnel from the supplier country. More often than not, they create patterns of dependency and strategic vulnerability between recipients and donors of military technologies.

The nature of strategic relationships generated and maintained through the transfer of critical technologies is a somewhat overlooked aspect of security policy, even though these alliances can have an undeniable impact on bilateral relations. Technological developments and aspects of production are generally not sufficiently taken into account by political science. This is deplorable given the „momentous causal impact” that changing levels of technological innovation capability can unfold in the international system. As Maximilian Mayer, Mariana Carpes and Ruth Knoblich point out:

large technical systems [...] as well as the technological zones that facilitate production, trade, finance, communication, surveillance, and weapon systems are far more complex, multi-sited, and interconnected than any state-centric framework of social collective action allows for.

The analytic perspective taken in this paper therefore falls into the group of „assemblage approaches“ within the broader framework of studies of Global Politics of Science and Technology identified by Mayer et al.

The lack of a military-industrial perspective is particularly striking in the case of writings on Russia’s 2014 invasion of Crimea. Although few analysts fail to mention the importance of the strategic naval base of Sevastopol as

1 A preliminary version of this study was presented at 57th ISA annual convention at Atlanta during March 16th-19th, 2016. The author would like to thank Tony Porter, Peter Hugill, and Peer Schouten for their comments, and Joachim Krause and Johannes Mohr for their constructive criticisms and helpful suggestions.

2 These observations are partially based on market analyses conducted by the author during 2007–2010 while working as a naval analyst in the German shipbuilding industry. The research contained in this paper was partially conducted in preparation of a book on China’s naval power (Kirchberger 2015) and then expanded to incorporate more recent developments.


one of the geostrategic incentives for the Russian violation of Ukraine’s territorial integrity, very few scholarly analyses point out the strategic interests of Russia in maintaining control over other key Ukrainian military and military-industrial infrastructures on Crimea – among them the sole aircraft carrier pilot training center available to Russia at the time: NITKA.\(^5\)

As a result of their Soviet-era ties, Russia and Ukraine maintained a quasi-symbiotic division of work in arms development after 1991. When Russia invaded Crimea and seized some key Ukrainian military infrastructures in 2014, this led to the breaking off of all co-operative arms production between both countries. The breakdown of a more or less symbiotic military-technological co-operation now offers the chance to study the strategic and economic aspects of such ties. The question is: what consequences will the breakdown have on the development of the respective industrial infrastructures and innovation systems?

The focus of this analysis is not only on Ukraine and Russia, but includes China. The People’s Republic of China (PRC) has traditionally sourced most of its defense technology from the Soviet Union and later, from Russia. After 1991, the PRC forged increasingly strong ties with the Ukrainian military-industrial complex to balance its one-sided dependency on Russian systems and technical support. China is therefore directly affected by the current crisis between its two main suppliers of military high technology.

Against the backdrop of the U.S./EU arms embargo against China, which restricts China’s choice of arms trade partners considerably, and given the Western and Ukrainian sanctions imposed on Russia after the Crimea crisis, the military-industrial triangle between China, Russia and Ukraine is a particularly fascinating case for studying the genesis and management of dependency issues in mil-tech co-operation. The following analysis aims to explore the impact of the Crimea crisis on the military-technological co-operation between Russia, China and Ukraine from the viewpoint of production.

2 Characteristics of transnational arms production

One reason for the relative durability of transnational arms production arrangements is the fact that the more complex types of military hardware, such as fighter jets, naval vessels, and key component systems such as advanced propulsion plants or modern sensors typically require constant access to a myriad of spare parts as well as the producer’s maintenance services. Sometimes this requirement gives rise to the formation of a specialized maintenance, training, and logistics infrastructure within the recipient country operated by personnel from the supplier country. This in particular tends to give the seller of the system (and thus the government of the seller’s country of origin) undeniable political leverage. As Krishnan puts it,

> The export of more complex equipment […] usually implies that the exporting countries provide the support capacities for the equipment, which could be withdrawn at any time. This means that there is more uncertainty on both sides: the arms suppliers have less control over the degree to which technology is transferred, while the recipients cannot be sure, whether the support for imported systems can be secured in the long term.\(^6\)

The political ramifications associated with large-scale arms transfers for both parties should therefore not be underestimated.

It is not unusual for partners in transnational arms producing arrangements to periodically experience friction. Conflicts typically pertain to alleged reverse engineering of advanced technologies by the recipient country, or to supposedly insufficient transfers of technology by the donor country, and often involve conflicts over cost overruns or delays. Notwithstanding such disagreements, these types of co-operations usually prove extremely durable, especially if a formal security alliance or defense co-operation agreement is simultaneously in place. An external factor that can enhance the durability of co-operative arms production would be a lack of alternatives on the part of the recipient country. This is the case for China, due to an arms embargo that has been imposed by the U.S. and the EU in 1989.\(^7\)

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5 A recent collection of four studies titled Roots of Russia’s War in Ukraine (Wood et al. 2016) discusses a wide variety of aspects of the Ukraine crisis, but excludes the dimension of co-operative arms production and the related friction resulting from Ukraine’s turn towards the EU and NATO. Similarly, only a few of the chapters contained in an edited volume by Howard and Pukhov (2015) which is concerned exclusively with military aspects of the crisis make mention of the mutual arms-trade relationship between both countries.


7 Interestingly, the occupation of Crimea in 2014 brought about a somewhat similar situation for Russia. A major Franco-Russian naval shipbuilding arms deal for the procurement of Mistral class amphibious vessels (LHDs) was suspended, and further Western sanctions against Russia were imposed, while Ukraine stopped all arms co-operation with the Russian aggressor, affecting e.g. the joint Antonov aircraft development.
2.1 Critical technologies and their production

In the area of arms production, most countries find themselves entangled in a web of hierarchical power relationships as either a self-sufficient producer, a donor/exporter (supplier), or a recipient (customer) of certain technologies vis-a-vis a variety of other countries. They can perform different types of roles relative to some countries than towards others; the same country can therefore simultaneously be a supplier and a customer of different kinds of military technology.

Depending on the type of arms technology under study, or with respect to the overall picture of their exchange relationships, countries may belong to different tiers within the global hierarchy of arms production as conceptualized by Keith Krause (cf. Table 1).  

Table 1: The hierarchy of arms production

<table>
<thead>
<tr>
<th>Tier</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-tier suppliers</td>
<td>&quot;innovate at the technological frontier&quot;</td>
</tr>
<tr>
<td>Second-tier suppliers</td>
<td>&quot;produce (via the transfer of capacities) weapons at the technological frontier and adapt them to specific market needs&quot;</td>
</tr>
<tr>
<td>Third-tier producers</td>
<td>&quot;copy and reproduce existing technologies (via transfer of design), but do not capture the underlying process of innovation or adaptation&quot;</td>
</tr>
<tr>
<td>Fourth-tier (&quot;strong&quot;) customers</td>
<td>&quot;obtain (via material transfers) and use modern weapons&quot;</td>
</tr>
<tr>
<td>Fifth-tier (&quot;weak&quot;) customers</td>
<td>&quot;either obtain modern weapons and cannot use them, or do not even obtain them&quot;</td>
</tr>
</tbody>
</table>


A country’s power position in its bilateral relationships is partly determined by its status within the techno-political dimension of these transnational arms production networks, and at the same time, its position offers various levers for exercising influence, e.g. by withholding technical support, or, in the case of the customer country, payment. In extreme cases, customers can threaten to break off arms trade relations and switch alliances to other partners, which could have strategic repercussions regarding the betrayal of military-technological secrets. The dependencies created through arms-trade relationships are clearly not one-sided.

Another factor to be considered is the degree of criticality of a particular piece of defense technology. There is a structural inequality between states generated by their technological innovation capacity and their level of access to high technology through imports or innovation. Arms technologies can likewise be conceptualized and classified into different levels of criticality regarding their strategic value on the one hand, and regarding the relative difficulty of their production, reproduction, maintenance or deployment on the other. Not all arms technologies are similarly critical.

What technologies are considered critical varies throughout history and depends largely on a country’s individual strategic situation. As Bruce A. Bimber and Steven W. Popper note, the quality of criticality is “not inherent in the technology itself.“ Rather, it stems from “the importance of the outputs of the system of which the technology is a constituent part, as well as from the significance the technology has for enabling that system.” It follows that only some, but not all types of arms technology are important for assessing military (and by extension, national) power. A country’s ability to produce the so-called critical technologies indicates the military-industrial power fault lines within the current world order.

For a country aiming to enhance its geographic reach and gaining strategic superiority over its rivals in territorial conflicts such as the ones China is involved in in the East China Sea, the South China Sea or regarding Taiwan, technologies needed for „network-centric warfare“ scenarios are clearly critical. This includes powerful sensors, e.g. phased-array radar antennas, as well as computer networks, encrypted data links, and specialized software able to interpret the data and distribute it to various units sharing a tactical picture. It also includes a space-based infrastructure of satellites covering the relevant areas at all times that can enable surveillance, navigation, and communication. The Chinese emphasis on an „informationization“ strategy of its armed forces likewise points to the criticality of these types of technologies. Due to China’s strong emphasis on anti-access/area denial capabilities in its deterrence strategy against the United States, missile technology is similarly critical.

10 Exactly what technologies should be labeled critical in any given context is subject to debate, but according to Tellis et al. there exists at least “a loose consensus in government, industry, and among technologists on which technologies today are deemed to be critical,” with extensive lists drawn up regularly in the U.S. Tellis et al. also note that an authoritative U.S. study identifies ca. 2,060 militarily significant technologies, among them 656 critical for the purposes of developing advanced weaponry. Tellis et al. 2000: 53–55.
Apart from these examples, some other types of defense technologies can universally be regarded as critical because they enable the basic functioning of various key weapon systems. Certain types of advanced propulsion plants that bestow high speeds and/or long range would be examples of such inherently critical technologies, with naval gas turbines, jet engines, air-independent propulsion plants (AIP) and nuclear propulsion plants the most notable items that are also extremely difficult to copy, reproduce and maintain and that can each only be produced by a very small, single-digit number of suppliers worldwide.

In most arms producing countries, critical technologies are restricted from export except to the most trustworthy of allies, and even then, are often made available only in a downgraded version. Neither Russia nor the Soviet Union has ever exported its state-of-the-art critical technologies to a potential rival like China. Actual transfers of advanced arms technology are therefore relatively rare, cementing the situation of a relatively small core and a widespread and layered periphery in global arms production.\(^\text{13}\)

### 2.2 The position of China, Russia and Ukraine within a „hierarchy of arms production“

China is a particularly interesting case for studying the effects of co-operative arms production under embargo conditions. As Tai Ming Cheung has described in-depth, China long struggled to build a modern and self-sufficient defense industry capable of supplying its armed forces.\(^\text{12}\) Using Krause’s above-cited system of tiers to describe innovation capacity in arms production, China must as of early 2017 still be considered a third-tier arms producing country in many high-end technology fields.

A 2011 assessment by Richard Bitzinger concludes that „the technology gap between China’s defence industry and the leading Western arms producers remains significant in several critical areas.“\(^\text{13}\) This description is supported by more recent analyses which indicate that Chinese attempts to replicate and replace e.g. foreign jet engines or phased-array radars seem to have been less than successful, and have apparently not achieved the desired progress despite years of effort, high-level political backing, and the input of vast financial resources.\(^\text{14}\) Thus, while China’s arms industries can definitely „copy and reproduce (apply) existing technologies (Krause’s 3\(^{\text{rd}}\) tier of arms production),“ it does not so far, in a general sense, seem to „capture the underlying process of innovation or adaptation“ (2\(^{\text{nd}}\) tier) – at least not in some of the critical arms technology fields, notably jet engines, gas turbines, and some advanced sensors and electronics. Otherwise, there would be no need to import advanced military technologies as complete weapon systems from Russia, although indigenous systems are being developed at the same time. China has nonetheless repeatedly done this, for instance when procuring Soviet-era Sovremenny class destroyers, Kilo class submarines and different types of Sukhoi fighter jets. Neither would China in that case need to produce gas turbines, naval diesel engines, or fighter jet engines under license agreements with Ukraine, Germany, or France, as it has been doing in recent years.\(^\text{15}\) In a few select technology fields, China is however probably able to produce at the technological frontier, which is a second-tier capability in Krause’s system. In some niche competencies, China may even be a first-tier producer, e.g. in ballistic anti-ship missiles (ASBM). The true quality of Chinese missile systems is hard to determine though, given the lack of reliable performance data. A recently concluded procurement agreement between China and Russia for six battalions of the S-400 air defense system indicates that China is not among the technological leaders in this particular field.\(^\text{16}\)

Ukraine can best be conceptualized as a second-tier arms producer within a certain range of critical military technologies, in particular propulsion systems (notably gas turbines) and in some areas of aerospace technology. Some of the Ukrainian-produced systems are based on older Soviet-era technology, but nevertheless are attractive enough to be imported by China in the absence of state-of-the-art alternatives from either the U.S. or the EU. Sensor technologies seem to have been another key area of Ukrainian competence that was especially interesting to China, given that Ukraine apparently sold a prototype phased-array radar system to China upon which the indigenously developed active phased-array radar system nicknamed Dragon Eye was based.\(^\text{17}\) Last but not least, it was Ukraine who sold China the empty hull for its first

\(^{11}\) For more detail cf. the discussion in Kirchberger 2015: 117–122.

\(^{12}\) Cheung 2009.

\(^{13}\) Writes Bitzinger, „despite more than 15 years of [...] aggressive acquisitions on the part of the PLA, the bulk of the Chinese military remains relatively backward [...]“. Even many of the PLA’s most recently acquired systems, such as the J-10 fighter jet, the Yuan-class submarine, and the Luyang-II destroyer [...] are basically 1980s-era weapons systems“. Bitzinger 2011: 14–15.


\(^{15}\) Johnson 2013 a.

\(^{16}\) Schwartz 2017.

\(^{17}\) Friedman 2006: 222–223.
aircraft carrier, the Liaoning, which was later fitted with a propulsion system and finished in China.

Russia on the other hand must be conceptualized as a first-tier producer in some arms technology fields, and as a second-tier producer in others. It remains a principal supplier of military technology for many countries in the world, among them China, India and Vietnam. India has however received access to far more advanced arms Russian technologies than China ever did, including such strategic transfers as the internationally unprecedented leasing of a fully functioning nuclear-powered attack submarine and the extensive refurbishing and sale of a used Kuznetsov class aircraft carrier hull.

3 The genesis of a strategic military-technological triangle between Russia, China and Ukraine

The collapse of the Soviet Union caused the splitting up of the Soviet military-industrial complex, ended the bipolar world order and created a novel set of incentives for Russia, China, Ukraine, and many other powers to restructure their defense-industrial alliances. While some former Warsaw Pact countries began to orient themselves towards Western technical standards in light of their envisaged NATO accession, the erstwhile enemies China and Russia discovered new chances for co-operation.

3.1 China as a recipient of Soviet and Russian technology until the arms embargo of 1989

Ever since the PRC’s foundation in 1949, an internationally isolated China had been heavily dependent upon Soviet military aid. Beijing imported complete production infrastructures, various arms technologies as well as Soviet institutions and guidelines for training and maintenance. The Soviet aid therefore amounted to the transplantation of an entire organizational culture, and its legacy far outlasted the actual strategic partnership between China and the USSR which ended already during the early 1960s. Its lasting influence is notable within the Chinese military-industrial complex and within the organizational culture of the armed forces even today.¹⁸ Nevertheless it must be noted that Soviet assistance has never been comprehensive, as the USSR never shared any of its state-of-the-art military equipment with China. After the Sino-Soviet split China was forced to develop its nuclear weapon programs alone, and had to make up for the resulting deficiencies with indigenous development of its arms industries, usually starting off from reverse-engineering of older imported Soviet systems.¹⁹ China continued to use its vintage Soviet weapon systems and in parallel furthered indigenous developments that were, however, based upon those older Soviet models.

After the end of the Mao era, a more diverse choice of foreign technologies briefly became available to China during the 1980s.²⁰ Due to Sino-Soviet tensions and warming relations with the U.S. during the 1970s and 1980s, the Reagan administration began to relax high tech transfer regulations. In 1984, the PRC was even granted eligibility for the U.S. system of Foreign Military Sales (FMS), the major U.S. arms export support program, which includes a financing tool named Foreign Military Finances (FMF) for arms purchases from U.S. companies. A number of arms deals were thus concluded in the following years.²¹ At the time, this U.S. arms transfer strategy was „aimed mainly against the USSR.“²² From the Chinese perspective, this was most welcome, not least because it allowed for an upgrade of China’s own production facilities:

[D]efense enterprises and their civilian counterparts concentrated on the import of large-scale plant equipment that was based on the requirements and orders of government ministries. This approach was reminiscent of the wholesale importation of Soviet factories during the 1950s. The primary objective of the procurement strategy was to renovate outdated manufacturing capabilities.²³

The cooperation with the U.S. included joint projects in avionics and in the construction of fighter-aircraft power plants as well as American GE gas turbines for powering large naval vessels. Other advanced foreign systems obtained during that time were French and Italian sensors, guided missiles and electronics. Even after the embargo of 1989, some Western nations continued to deliver various types of defense technologies to China (cf. Table 2).²⁴

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¹⁸ Li 2009: 122–125.
²⁴ Apart from production infrastructure upgrades, there was an influx of procedural and management knowledge that became available to Chinese experts for the first time through direct interaction with Western counterparts. Cheung 2009: 91.
Table 2: Foreign weapon systems on PLA Navy vessels after 1989

<table>
<thead>
<tr>
<th>Source</th>
<th>No.</th>
<th>System</th>
<th>Year(s) of delivery</th>
<th>Vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>2</td>
<td>100mm Naval Gun</td>
<td>1989</td>
<td>1 Jianghu II FFG</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Castor-2 Fire Control Radar</td>
<td>1994–2002</td>
<td>2 x Lühu, 1 x Lühai, 3 x Lüda I DDG, 8 x Jiangwei II FFG</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>DRBV-15 Sea Tiger Radars</td>
<td>1987–1999</td>
<td>2 x Lühu, 2 x Lühai, 2 x Lüda I DDG</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>DUBV-23 Sonars</td>
<td>1991–1999</td>
<td>2 x Lüda, 1 x Lühai, 2 x Lühu DDG</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>DUBV-43 Sonars</td>
<td>1994–1996</td>
<td>2 x Lühu DDG</td>
</tr>
<tr>
<td></td>
<td>336</td>
<td>R-440 Crotale SAM</td>
<td>1990–2002</td>
<td>2 x Lühu, 1 x Lühai, 3 x Lüda DDG</td>
</tr>
<tr>
<td>Italy</td>
<td>17</td>
<td>RTN-20S Fire Control Radars</td>
<td>1991–2001</td>
<td>2 x Lühu, 1 x Lüda III, 1 x Lühai DDG, 6–7 Houjian PTG</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Ka-27PL (Helix-A) Helos</td>
<td>1997–2000</td>
<td>Various</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Fregat/Top Plate Air Surv. Radars</td>
<td>2004</td>
<td>2 x Lüzhou, 2 x Lüyang I DDG</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>MR-90/Front Dome FC Radars</td>
<td>2004</td>
<td>2 x Lüzhou, 2 x Lüyang I DDG</td>
</tr>
<tr>
<td>Russia</td>
<td>144</td>
<td>48Ng/SA-10 Grumble SAM</td>
<td>2002–?</td>
<td>2 x Lüzhou DDG</td>
</tr>
<tr>
<td></td>
<td>264</td>
<td>9M317/SA-17 Grizzly SAM</td>
<td>2005</td>
<td>2 x Lüyang I DDG</td>
</tr>
</tbody>
</table>

Kilo-class SSK, Sovremenny-class DDG (imported as complete weapon systems)


Most of the exchanges with Western arms producers came to a sudden halt after the June 4th, 1989 incident, however. Hundreds of already concluded contracts with U.S. producers were suspended, and at least 300 export agreements were blocked due to U.S. sanctions and the resulting arms embargo alone. They were only slightly relaxed after China signed the Non-Proliferation Treaty in 1994. U.S. sanctions have since been employed as „leverage to encourage China to cooperate with the United States on a host of international security concerns such as nuclear proliferation and missile technology“.25 They continue to pertain mainly to four especially sensitive areas: missile technology, nuclear technology, intelligence-gathering technology, and anti-submarine warfare technology.26

The disruption caused by the 1989 embargo to China’s then ongoing arms programs was severe. It affected several sensitive projects because vital subcomponents (such as the above mentioned American gas turbines) could no longer be obtained.

Ever since, China has officially been excluded from any strategic arms trade partnerships with the leading Western arms producers, and is limited to trading with these powers in dual-use technology areas such as aerospace, and is trying to make up for this by a dual strategy of importing older technology (mainly from Russia and Ukraine) and concurrent indigenous development. Due to the powerful Soviet technological legacy remaining today in China’s military industries, these attempts typically use Soviet design principles as their starting point. In order to close the technology gap to Western state-of-the-art technologies, China’s arms industries have, no doubt with high-level political backing, in the past resorted to a variety of coping strategies, among them „academic exchanges and ‘state-sponsored espionage’“ in which foreign dual-use technologies are exploited for their military potential.27

Apart from regular export orders and voluntary technology transfers by willing partners such as Russia and Ukraine, „less voluntary transfers include forced technology transfer in joint ventures, certification practices, and espionage activities. “28 A typical complaint often made by foreign technology providers concerns the alleged Chinese propensity for reverse engineering foreign systems,

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27 Anderson 2011 b.
28 Stumbaum 2009: 11, fn. 17.
Western and Russian alike. To this end, China seems to have repeatedly obtained access to „captured“ military technology, e.g. unexploded and exploded shells of U.S. cruise missiles collected from Iraq, Serbia, Afghanistan, and Sudan; and wreckage of aircraft such as the F-117 stealth attack aircraft shot down in Serbia in 1999. In 2011, U.S. defense officials voiced concerns that Pakistan, China’s all-weather friend and principal arms trade customer country, could allow China access to the wreckage of an unidentified stealth helicopter that was left behind during the Bin Laden assassination on Pakistani soil on May 1st, 2011.29

3.2 Russia’s arms trade with China after 1991

The Soviet Union’s collapse in 1991/1992 markedly changed the strategic arms-trade situation from the Chinese point of view, with cash-strapped Russian and Ukrainian industries offering assistance for China’s military modernization. The reasons for this were mostly economic. Until the mid-1980s, the Soviet Union had been a major arms producing state on par with the U.S. The sharp economic decline suffered by Russia after 1992 led to a very difficult situation for the Russian defense industrial base. Its share in the world’s arms production dropped dramatically, from one third of the world’s total production prior to 1985 to a mere 4 percent by 1996. According to Tsai, in 1992,

[... ] nearly 21 percent of Russian defense enterprises stood on the verge of bankruptcy, while 43 percent would soon be classified as barely viable. By 1993, the financing of arms production had been reduced by nine times, and Russian military orders were fulfilled by no more than 10–15 percent of the defense industry’s production capacities.30

The Soviet Union’s major naval shipyards had been inherited by Ukraine, not Russia, after 1992. Several large-scale naval shipbuilding projects destined for the Soviet Navy were left unfinished, including the Varyag aircraft carrier hull later acquired by China and re-christened the Liaoning. The Russian arms industries have since recovered somewhat, but still, according to Russian news reports from 2009 cited by Neuman, „only 36 percent of Russia’s strategic defense companies [were] solvent – and many of these survive[d] only due to export orders – while about another 30 percent [were] on the verge of bankruptcy.”31

Russia’s arms industries, whose products are marketed abroad by the Russian export agency Rosoboronexport, are with very few exceptions state-owned.32 Their dependence on export orders is nevertheless high. According to the above cited study, export orders constitute about 60 percent of total sales, and „some R&D and production programs are tailored specifically for foreign customers rather than the Russian military itself”.33

The politico-strategic importance of the arms industries in Russia’s domestic politics becomes obvious when the sector’s size and economic impact is taken into account. Estimates for the year 1994 assume that the defense industrial sector’s output contributed to nearly 60 percent of Russia’s entire industrial production, and had about four million employees working at ca. 2,000 facilities, with 80 Russian towns – so-called „defense industry towns“ – almost entirely dependent on the local defense industries for their economic viability.34

Sales information published by Rosoboronexport in 2014 indicates that Russia exported arms technologies worth US$ 13.2 billion to 60 countries worldwide in 2013, and further, that a group of only six countries accounted for ca. 75 percent of these sales: Algeria, China, India, Indonesia, Venezuela, and Vietnam.35 Assessments published by Jane’s Defence Weekly in 2011 conclude that Chinese defense imports from Russia during 2000–2011 had an annual value of ca. US$ 1 to 3 billion. On the whole, China accounted for ca. 20 percent of Russian export orders during 1997–2007.36 Russia is thus China’s primary source of modern defense equipment in quantitative (as well as qualitative) terms, while the value of Ukrainian exports to China was taxed at an average of a few hundred million US$ per year.37

Meanwhile, the fact that Russia’s defense industries have not yet fully recovered is illustrated by Russia’s relatively recent attempt to become an importer of Western naval technology. The deal concluded with French shipbuilding group DCNS in 2011 over the sale of two Mistral class LHDs (or helicopter carriers) indicates a lack of Russian design capability for producing such advanced amphibious vessels, even though an LHDs’ level of technical complexity is much lower than in guided-missile destroyers, for instance, which Russia can build. This has been freely admitted by Russian officials. Russia’s naval

29 Parsons 2011.
30 Tsai 2003: 121.
32 Adomeit 2017: 40–41.
34 Tsai 2003: 121.
36 Anderson 2011 a.
37 Grevatt 2011.
industries therefore cannot be considered technologically on par with the most advanced Western shipyards. According to data and analyses cited by Peter Dunai and Guy Anderson, R&D spending in Russia remains at markedly lower levels than in all the Western countries (ca. 33 percent of Germany’s and 5 percent of U.S. R&D spending), while productivity in the Russian shipbuilding industry was also deemed to be much lower. Build times, namely, were estimated to be between two and two and a half times longer when compared to foreign competitor yards, and required construction hours were estimated to be three to five times higher. 38

China, along with its strategic rivals India and Vietnam, has remained one of Russia’s major arms export customers for quite some time. This means that the People’s Liberation Army (PLA) is probably best disposed to absorb advanced technologies from this and other post-Soviet sources, such as Ukraine, due to established maintenance and training routines and infrastructures. There are moreover indications that China’s military industries continue to have a few things to learn from Russian technology.

During the mid-1990s, China decided to import Soviet-era vessels and aircraft such as the four steam-powered Sovremenny class destroyers as complete weapon systems at a time when several indigenous Chinese destroyer programs were simultaneously underway. Starting from 1994, China opted to purchase altogether 12 Kilo class diesel submarines, even though it was building its own indigenous submarine designs at the same time. Furthermore, the PRC imported Sukhoi fighter jets. This trend has continued despite expectations to the contrary expressed by Western observers, and indeed another, similar sized large-scale arms deal has only recently been concluded between the two countries. This deal includes the sale of 24 advanced Su-35 fighter aircraft and four Lada class diesel submarines, which would represent a noticeable improvement over the existing Chinese Kilos. 39 The recent abortion of Russia’s Lada program has made the latter part of the deal look less certain though.

China could have planned to take advantage of the major „naval and maritime redevelopment plan“ officially announced by Russia in early 2013, which includes plans for heavy investments in Russia’s shipbuilding industry infrastructure, as well as large series of new buildings for the Russian Navy. According to this ca. US$ 42 billion plan, Russia aims to build 50 modern surface vessels and 20 submarines by 2025. 40 If actually implemented even in the face of the current economic crisis, it could offer synergies effects through economy of scale to Russia’s major naval customers, including China. Russia, on the other hand, also likely evaluates the arms trade relationship with China in strategic terms:

While commenting on Russian arms transfers to China, one Russian military officer stressed that apart from the purely economic advantages, supplying weapons to China could provide a chance of influencing China’s military and political strategy and maintaining ally-like relations with that country. As such, Russia might increase its political leverage in the region and in relation to the U.S. 41

Notwithstanding the emerging convergence between Russian and Chinese strategic interests the Russian-Chinese export relationship has never been free of friction. 42 There have been several indications in recent years that Russia’s defense industries have become more cautious in their dealings with China due to repeated reverse-engineering issues. 43 Chinese engineers seem to employ this strategy fairly regularly, as interviews with Russian arms industry sources published by Kanwa Asian Defence suggest. In its December 2009 issue, Kanwa cited several Russian defense industry representatives who implied that China regularly imitates Russian equipment. Oleg Azizov, the then Director of the Navy Equipment Department at Russia’s official arms export agency Rosoboronexport, stated at a press conference that China obtained the Mineral-ME serial radar system and the Fregat-ME radar system as a result of their acquisition of the Sovremenny-class destroyers. Shortly afterwards, „almost identical ‘cloned versions’ of these radar systems made an appearance on China’s indigenous 054A [„Jiangkai II“ class] FFGs“. 44 An unnamed representative from Russia’s Typhoon Design Bureau elaborated:

China purchased a total of 8 Mineral-ME radar systems along with a large amount of spare parts, sufficient to assemble several additional sets. We had some suspicion at that time. Shortly after that, the Chinese invited our technical expert group to visit and pleaded us to help assemble ‘back-up radar’ in China. They had sufficient parts, but our expert group refused, as the assembling work was not easy and required special equipments [sic] as well as approval from the authority. Following that, our experts received several reports from the Chinese side, claiming that the systems we provided had encountered technological problems. After our technical experts examined the

38 Dunai/Anderson 2013.
39 Foster 2012 und Johnson 2013 b.
40 Dunai/Anderson 2013.
41 Tsai 2003: 123.
43 Reverse-Engineering „defines the process of discovering the technological principles of a device, object or system through analysis of its structure, function and operation.“ Stumbaum 2009: 11, fn. 17.
44 „Frictions between Russia & China“ 2009: 15.
systems, we noticed some of the parts were not original, and this meant that they had started imitating the component parts of the radar. Through such contacts with our experts, they intended to identify the problems in their imitation projects.

A different representative of the Russian arms industry was also cited as follows:

[T]hey did not acknowledge that they imitated our radar. They said that they designed the radar independently and had full intellectual property rights of the equipments [sic]. We believe that anyone with common sense would know from the physical appearance of those systems that they were the same systems [...] [T]he distrust in China within the [Russian] industry is growing, and we have decided at [a] strategic level that the Chinese market will no longer [be] a priority.

The above mentioned Mineral-ME (NATO nickname „Band Stand”) system was the first over-the-horizon fire control radar system in China’s navy. To this day, it (or its reverse-engineered clone) can be found on all the newly built large naval surface vessels.  

Kanwa reporters also noted that one of the 12 Kilo class submarines seemed to have been continuously berthed for at least two years. This suggests that China may have used this boat for reverse engineering and maintenance testing purposes. According to the report, the Russian Ministry of Defense has listed the Chinese Type 041 „Yuan” class submarine as an „imitation” of the Kilo class.  

3.3 China’s military-industrial complex and arms import strategy under embargo conditions

The mid-1990s „missile crisis” between China and the U.S. surrounding Taiwan’s first democratic presidential elections in 1996 ushered in a period of enhanced military modernization in China, leading to a faster pace in its arms production.  

As a result, China’s defense economy has become much more multi-layered and complex. In 2012, China’s defense industry sector already encompassed more than 1,000 state-owned enterprises organized under eleven large fully state-owned holding companies, and employed over a million workers. If the entire defense industrial base including privately owned subsidiaries and other private companies active in some form of military production is taken into account, estimates of the Chinese military-industrial complex run as high as ca. 10,000 firms and ca. 2.5 million employees.  

A pronounced dip in Chinese defense imports between 2007 and 2011 of ca. 58 percent according to SIPRI, and a simultaneous increase in Chinese arms exports of 95 percent between 2001 and 2011 seemed to indicate that much progress had been made towards China’s ultimate goal of self-reliance in defense production. Likewise, China’s military export activities e.g. with Pakistan seemed to indicate a rise in the „ladder of production” from a „third-tier producer” overall to a „second-tier supplier” at least in some fields.

Nevertheless, this has been mostly the case in the field of land systems, while several critical technology areas in air and maritime defense still rely heavily on foreign

45 „Frictions between Russia & China” 2009: 15.
47 „Russia and China have a widening difference on battleship maintenance” 2009: 16.
48 Cheung 2009: 19.
49 Lague/Zhu 2012.
50 Grevatt 2013.
51 Lague/Zhu 2012.
imports, despite decades of intense domestic R&D activity. These weaknesses include a lack of indigenous production capability for high performance jet engines, which are still imported from Russia; for gas turbines, which are produced under license from Ukraine; and for naval diesel engines for surface combatants and submarines, which are imported mainly from Germany (MTU) and France (Pielstick) or produced under license from these companies. Propulsion plants, both in jets and warships, are of course critical components. China’s persistent dependence on outside supply sources in such strategically relevant technologies despite long-term efforts to overcome this dependency is therefore quite telling.\footnote{52} Another area where China is still dependent on outside assistance concerns big military transport aircraft and helicopters. Many electronic systems aboard Chinese naval vessels and aircraft are either imported or based on earlier imports from Russia or Western countries. A 2013 assessment of China’s status as a producer in Jane’s Defence Weekly thus concluded that:

\[\text{The existing capability gap between China and the industrialised states of the West and Russia is apparent in the Chinese industry's generally unsuccessful attempts to develop and produce major systems such as aero-engines and a wide range of fourth- and fifth-generation technologies that will enable China to reach its ‘informationisation’ goal.}\footnote{53}

More recent analyses concerning China’s import behavior towards Russia and Ukraine continue to support this conclusion. Official reports published in China’s state media in 2012 and 2013 concerning the new massive arms deal between Russia and China over the sale of 24 Su-35 fighter airplanes and 4 Lada class submarines that was officially announced in November 2015, pointed toward a still-existing gap between Chinese and Russian defense technologies. This illustrates a persistent deficiency in China’s innovation capacity at the state-of-the-art level in some of these critical naval and aerospace technologies.\footnote{54} There would otherwise be no need for China to import new complete weapon systems from Russia again, or to ask for technology transfers and joint production.

This view is also supported by Cheung’s analysis. He concluded from his extensive analysis of China’s defense industry modernization effort over the past few decades that the majority of Chinese defense products had by 2009 reached the technological standard of the late third generation (comparable to arms produced in the West during the late 1960s to early 1970s), while early fourth generation (Western 1990s production) levels had been reached in a few select areas, e.g. with some missiles, the F-10 fighter aircraft, and the T-98 main battle tank. According to Cheung, „[w]hile this progress is significant (on the whole), the Chinese defense economy still lags as much as two generations behind the latest global standards in most areas.\footnote{55} Even though this assessment was made several years ago, it remains doubtful whether technical co-operation with Russia will be able to remedy this problem. Quite recently, it became apparent that the latest Russian Sukhoi T-50 PAK-FA fighter, despite being announced as a fifth-generation plane, may in fact lack the defining capabilities of the fifth generation.\footnote{56}

Table 3 shows Cheung’s evaluation of the major naval weapon systems and missiles according to this system of technical „generations."

\begin{table}[h]
\centering
\caption{Generational levels of major Chinese weapon systems}
\begin{tabular}{|c|c|c|}
\hline
\textbf{Weapon System} & \textbf{R&D/Production Status} & \textbf{Generational Category}\textsuperscript{*} \\
\hline
Type 051 „Lüzhou“ class destroyer  & dev. since late 1990s, operational since ca. 2006  & late 3\textsuperscript{rd} \\
\hline
Type 054 „Jiangkai I“ (Ma’anshan) class frigate  & dev. since late 1990s, operational since ca. 2003  & late 3\textsuperscript{rd} \\
\hline
Type 053H2G „Jiangwei“ class frigate  & dev. since mid-1990s, operational since 1996  & late 3\textsuperscript{rd} \\
\hline
Type 039 „Song“ class diesel submarine  & dev. since early 1990s, operational since 1998  & late 3\textsuperscript{rd} \\
\hline
Type 093 „Shang“ class nuclear attack submarine  & dev. since late 1980s, operational since 2006  & early 3\textsuperscript{rd} \\
\hline
Type 094 „Jin“ class ballistic nuclear sub  & dev. since late 1980s, operational since ca. 2008  & late 3\textsuperscript{rd} \\
\hline
DF-21 intermediate range ballistic missile  & dev. since 1980, in serial production since late 1980s  & late 3\textsuperscript{rd} \\
\hline
DF-15 (M-9) theater ballistic missile  & dev. since 1985, in serial production since mid-1990s  & late 3\textsuperscript{rd} \\
\hline
\end{tabular}
\end{table}

\textsuperscript{*}Generational definition follows U.S. and Russian convention. Chinese generational reckoning lags one generation behind because generation one was skipped in China altogether.

\textit{Source:} Adapted from Cheung 2009: 173.

\footnote{52} Cf. the discussion by Majumdar (2017) of the persisting Chinese problems with the development of an indigenous fighter jet engine.

\footnote{53} Grevatt 2013.

\footnote{54} For a Chinese state news report, see „Zhong E qianding junshou da dan“ 2013. For comments on the deal, see Johnson 2013 b and Foster 2012.

\footnote{55} Cheung 2009: 172.

\footnote{56} Johnson 2016 b.
Judging from these facts, it must be concluded that China seems still fairly dependent on Russian support and maintenance for existing Russian weapon systems imports. In terms of infrastructure, the servicing of various Russian-imported naval vessels even seems to have necessitated the development of localized Russian support enclaves in China. The high preponderance of Russian high technology in several mission-critical areas has thus undeniable repercussions on logistics and maintenance, creating a potential area of strategic vulnerability. Commenting on the older Lüda, Lühu and Lühai class destroyers, James C. Bussert and Bruce A. Elleman note that „even though these ships are indigenously constructed, and are evolutionary in upgrades, there are doubts if the crews can maintain, repair, and properly operate the complex systems at sea.“57

This problem is apparently even more severe with regard to the ship classes that were imported as complete weapon systems from Russia—the Sovremenny class destroyers and Kilo class submarines:

China is still largely dependent on Russian advisers for training and operations. Maintenance and repair of foreign equipment can be particularly difficult, and China’s Sovremennyyys rely on Russian technicians for maintenance. China was forced to return two Russian-made Type 2D-42 diesel generators to the Elektrosila plant in Russia for repairs.58

Information published by Kanwa Asian Defense further suggests that a large infrastructure of Russian technical advisors is in effect clustered in two isolated „support cocoons“ near the East Sea Fleet headquarters at Ningbo, which has become a necessity for maintaining the imported vessels:

The Sovremennyyys largely remain in the Russian support cocon at the isolated port of Dinghai, on Zhoushan Island, rather than at a large city fleet base. Russia repeatedly urges China to have overhauls conducted by its Zvezdochka Factory, which has facilities and documentation for 956E and EM as well as Kilo submarines. China repeatedly refuses and is trying to establish 956 maintenance capability at Bohai Shipyard, and Russia has so far trained thirty-five technical staff. Every piece of equipment was totally new to the PLAN except for the Palm Frond navigation radar, the RBU-1000 ASW launcher, the Kite Screech and FC radars, the SA-N-7 Shil SAM, and the Ka-28 ASW helicopter. [...] The modern Kilo submarines have a similar Soviet technical support enclave at the nearby harbor of Xiangshan, while Kilo submarine crews are trained and supported there.59

Extensive Russian technical assistance was seemingly necessary at least up until 2011 for these two imported ship classes. According to the above cited study it was „unclear whether the Chinese could keep these ships and submarines in good operational order“ if left to their own devices.60 The risk of such an arrangement lies in a heightened degree of dependency on the support of another nation—in this case Russia—which could at any time be reduced or withheld for political reasons. Another drawback consists in a reduced level of fleet integration if certain vessels need to be kept at a distance from other vessels due to their specialized support needs and if they require completely different training than other vessels of the same overall type. The planned new submarine and fighter jet co-operation between China and Russia must be evaluated against this backdrop.

3.4 Ukraine’s role as a supplier of advanced arms technologies to both Russia and China

Ukraine has been welcomed by China as an alternative supplier in some areas where Russia has been reluctant to share advanced technology. Documented instances where Ukrainian suppliers stepped in when Russia withheld technology or support concerned Kilo class submarine maintenance blueprints, phased-array radar technology, and last but not least, carrier technology.

Ukraine had been the first country to declare its independence from the Soviet Union in 1991. This was alarming from the point of view of Moscow on several accounts, not least because Ukraine had been more than a third of the entire Soviet Union’s military-industrial capacity.61 Among the key defense industries and infrastructures inherited by Ukraine were naval shipbuilding facilities which at a time „accounted for 30 % of the Soviet Union’s shipbuilding industry.“62 Further areas of Ukrainian mil-tech competence included heavy missile parts, armored vehicles, transport aircraft, naval gas turbines and jet engine production.63 In geostrategic terms, the loss of access to military bases on Ukrainian territory would have had unacceptable consequences for Russia. As the former U.S. National Security Advisor Zbigniew Brzezinski noted in 1997,

60 Bussert/Elleman 2011: 33.
61 Dunai 2015.
62 Moore 2014.
63 Dunai 2015.
Prior to 1991, the Black Sea was the point of departure for the projection of Russian naval power into the Mediterranean. By the mid-1990s, Russia was left with a small coastal strip on the Black Sea and with an unresolved debate with Ukraine over basing rights in Crimea for the remnants of the Soviet Black Sea Fleet, while observing, with evident irritation, joint NATO-Ukrainian naval and shore-landing maneuvers and a growing Turkish role in the Black Sea region. Russia also suspected Turkey of having provided effective aid to the Chechen resistance.\(^{64}\)

What has emerged after 1991 was a division of work – sometimes called a symbiosis – between Ukraine’s and Russia’s military-technological industries that included multiple instances of collaborative arms production. Furthermore, Russia leased the naval base of Sevastopol and the NITKA aircraft carrier pilot training base on Crimea from Ukraine. For the year 2013, estimates of Ukraine’s defense sales to Russia stood at ca. USD 400 million, or a quarter out of a total of USD 1.6bn defense sales during that year.\(^{65}\) The number of product lines provided by Ukrainian defense industries to Russia was estimated as ca. 3,000.\(^{66}\) In this arrangement, some areas of expertise remained the exclusive domain of one partner. In particular, Ukraine’s competency in jet engine and naval gas turbine production is an example of this.

In the year before the outbreak of the Crimea crisis, Russia and Ukraine’s Yanukovich administration had concluded far-reaching defense cooperation agreements. Ukraine had already decided to restructure its military industries after the Russian model by founding Ukroboronprom, an export agency similar to its Russian counterpart, Rosoboronexport. At the time, an analyst cited the Russo-Ukrainian Antonov An-70 military transport aircraft program as the „centerpiece“ of the bilateral defense cooperation.\(^{67}\) Another important area of co-operation concerned the continuation of the Russian lease of the NITKA aircraft carrier pilot training facility near Saky on Crimea. This testing and training complex „remains the only former USSR base equipped with the hardware necessary to train pilots to fly the Sukhoi Su-33 and Mi-Koyan MiG-29K carrier-capable fighters off Admiral Kuznetsov-class carriers.\(^{68}\)

Although the base was inherited by Ukraine after the Soviet Union’s demise, the Ukrainian Navy, due to a lacking carrier capability, had no use for NITKA.

Since China’s sole operational carrier, the Liaoning, is also an Adm. Kuznetsov class ship, China is another nation (alongside India) with potential interest in using the NITKA facility for training its pilots. Russia, for its part, still has no comparable installation on its own territory to train its pilots. Prior to the invasion of Georgia, Russia had leased this facility and paid for its use through counter-trade, „a large portion of which were aircraft parts for Sukhoi fighter aircraft still operated in Ukraine“.\(^{69}\) The new agreement foresaw cash payments, but shortly before the outbreak of the Crimea crisis, in late 2013, Ukraine reportedly made plans to offer NITKA for exclusive use to China’s PLA Navy Air Force (PLANAF), and to India as a back-up plan, because Russia was unwilling to pay a higher rent. Chinese officials have reportedly shown a great deal of interest in this facility and its personnel’s expertise, despite the fact that China is currently using an indigenous training facility near Xi’an which was modeled on NITKA.\(^{70}\) The 2014 annexation of Crimea finally resulted in the forcible Russian takeover of NITKA.

Concerning Ukraine’s relationship with China on the other hand it is safe to assume that China’s uncomfortable situation of quasi-dependence on Russian arms sales after 1991 contributed to Ukraine’s mil-tech expertise becoming an ever more interesting bargaining lever for China. Numerous disagreements between China and Russia regarding the maintenance and upgrade procedures of Russian-built Kilo class submarines have seemingly lead to a closer entente between China and Ukraine. According to an anonymous Russian industry source, talks about maintenance procedures between Russia and China dragged on for years because China insisted that all the necessary maintenance and upgrade work be done in China with the help of Russian experts, who were expected to train Chinese maintenance personnel. The Russians however insisted to do the work on specialized yards in Russia. The source further said that China turned to the

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\(^{64}\) Brzezinski 1997: 93.

\(^{65}\) Jane's estimates put the Russian share before India’s, but according to a Ukroboronprom official, India’s share in 2013 of USD 397.4 million was the largest which would put the Russian figure a little below that value. Cf. Dunal/Smith 2014 b and Anderson 2015.

\(^{66}\) Anderson 2015.

\(^{67}\) Areas of friction regarding the joint Antonov An-70 transport aircraft program prior to the Crimea crisis have been outlined as follows: „the Ukrainian aircraft manufacturer is requesting that USD100 million be paid by the Russian MoD for the third An-70 prototype“, a price tag Russian officials reportedly found much too high; moreover, there were reportedly „disagreements about adapting the An-70’s design documentation to conform to recent changes in performance requirements of the Russian Air Force, as well as digitising the full set of design drawings for transfer to the production facility in Russia.“ Johnson 2012.

\(^{68}\) Johnson 2012.

\(^{69}\) Johnson 2012.

\(^{70}\) Johnson/Hardy 2013.
Sevastopol shipyard in Ukraine, where it acquired *Kilo* class maintenance blueprints, albeit for an older version, and started the maintenance work in China independently with their help.\(^\text{71}\) The degree of success achieved through this unusual route is uncertain. The *Kilos* are rarely seen on mission, which could be a result of maintenance problems.

Another critical area of mil-tech where Ukraine granted support to China was phased-array radar technology. China had imported two Russian *30N6EI „Tombstone“* phased-array Flap Lid antennae for its *Type 051C „Lüzhou“* class destroyer program, which were the key component of the earliest potentially area-defense capable combat system installed on a Chinese warship.\(^\text{72}\) A Ukrainian radar technology transfer was however even more important for the ultimate development of an indigenous Chinese active phased-array radar antenna. China’s Nanjing Research Institute of Electronic Technology managed to develop an indigenous active electronically scanned phased-array radar system first seen installed in 2004 on the *Liuyang II* class destroyers, which is variously called the *Type 346* or the *Type 348 „Dragon Eye. “* Friedman assumes that this system was derived from a Ukrainian C-band active phased-array radar produced by Kvant Design Bureau, which was sold to China by Ukraine in 2004 with the necessary design and technical assistance package.\(^\text{73}\) *Dragon Eye* and its derivates are the core enabling components of the „Chinese AEGIS“.

### 4 Effects of the Ukraine crisis on bilateral mil-tech agreements between Ukraine, Russia and China

On 22 February 2014, the ousted Pro-Russian Ukrainian president Yanukovych fled to Russia against the backdrop of Ukraine’s Euromaidan revolution, a movement that had been sparked by the Yanukovych government’s decision not to sign an association agreement with the EU. Before, Russia had exerted tremendous pressure on the Ukrainian government to refrain from signing it – „notably with the threat – from Russian presidential advisor Sergei Glazyev in 2013 August – that bilateral defence industrial co-opera-

\(^{71}\) „Russia and China have a widening difference on battleship maintenance“ 2009: 16.
\(^{72}\) Bussert/Elleman 2011: 43.
\(^{73}\) Friedman 2006: 222–223; cf. also Wertheim 2013: 115.

\(^{74}\) Anderson 2014.
\(^{75}\) Kashin 2015: 17.
\(^{76}\) Anderson 2014.
January 1, 2016, joined a Deep and Comprehensive Free Trade Area (DCFTA) with the European Union, pointing to Ukraine’s unbroken intention to reach a deeper integration with the Western powers.

Through the annexation of Crimea and as a result of separatist activities in Eastern Ukraine, which resulted in Ukroboronprom losing effective control over some military industrial production plants, Ukraine lost ca. 10 percent of its entire defense industrial infrastructure, a significant share. The loss of Ukraine’s largest arms export destination, Russia, dealt another heavy blow to Ukraine’s military-industrial complex. To compensate for the loss of the Russian export share, since the outbreak of the crisis, Ukraine has strengthened ties and concluded defense cooperation agreements with Indonesia, Pakistan, Poland, Thailand, Saudi Arabia, and South Africa among others. According to official figures released by Ukroboronprom, Ukrainian defense exports in 2015 reached a value of USD 1 billion, a remarkably high figure.  

## 4.2 The meaning of Ukraine’s military-industrial complex for Russia

From the Russian point of view, the loss of access to Ukrainian deliveries resulted in a sudden need for Russia to substitute about 3,000 important product lines on short notice. According to an analyst’s assessment, replacing the previously imported items with indigenous developments will prove both costly and difficult for Russia. For instance, Ukraine is home to a production complex consisting of the Ivchenko-Progress design bureau and the Motor Sich production plant located in Zaporozhye in Southeast Ukraine that constitutes „one of the largest surviving aero-engine enterprises from the Soviet period“ and, according to local officials, „might be the only Soviet-era enterprise capable of designing and building a jet engine from scratch in a more or less standalone capacity.\(^\text{79}\)“ In the past, the incentive to overcome reliance on Ukrainian suppliers had been low because many components were „produced in small quantities and with low profit margins.” As Johnson points out:

Some higher-end items, such as the Motor Sich engine models for Russian helicopters and combat jet trainer aircraft and gas-turbine power plants for naval vessels from Zorya-Mashproekt in Mykolaiv, are almost incapable of being produced in Russia without huge investments, as are many of the items needed to support the regular operations of the Antonov An-124 Ruslan military cargolifters.  

The Motor Sich jet engine production facility is just one among several key industrial facilities that were producing critical components for Russian weapon systems. Writes Moore:

Basically all of Russia’s military helicopters use engines made by Motor-Sich. The firm also makes the engines for Russia’s Yak 160 fighter/trainer. Russian military analyst Vladimir Voronov says Russia has an ambitious plan to add 1,000 attack helicopters to its armed forces, but this would be almost impossible without Motor Sich’s provision of engines.  

Another major supplier to key Russian arms programs whose loss is difficult to compensate is Zorya-Mashproekt, one of the world’s leading producers of naval gas turbines. Customers of Ukrainian gas turbines apart from Russia, its former principal export market, include Belarus, India, China, Vietnam and South Korea. After the crisis broke out, Zorya-Mashproekt’s production faltered following the loss of the Russian orders, with capacity in mid-2014 officially running at 65 percent.\(^\text{83}\) From the Russian point of view, the loss of this co-operation is however perhaps much more problematic: Out of the 54 surface warships acquisition programs that the Russian navy has currently planned, 31 were designed to incorporate Ukrainian engines.\(^\text{84}\) Russia’s Deputy Prime Minister responsible for the defense industry, Dimity Rogozin, has publicly admitted in June 2015 that Russia cannot currently proceed with its ongoing surface ship construction programs that are designed around the currently non-available Ukrainian gas turbines, and has indicated that Russia will be able to produce its own indigenous gas turbines not before 2018.\(^\text{85}\)

In addition to the above named suppliers of critical components, Ukraine’s Kharkiv production facilities produce battle tanks and air-to-air missiles for fighter jets which are used by Russia, and the complex „is home to a vibrant parts and systems design and manufacturing in-

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\(^{78}\) NATO’s Communications and Information Agency (NCIA) signed a memorandum of agreement on cooperation in C4I (command, control, communications, computers and intelligence) with Ukraine on April 24, 2015 to assist Ukraine in the modernization of its C4I networks and enhance interoperability with NATO. NATO has also launched several trust funds under the leadership of various NATO nations on behalf of Ukraine, which pertain to areas such as C4I, logistics, medical care and military career management. For further detail cf. Tigner 2015 a and Tigner 2015 b.  

\(^{79}\) Anderson 2015.  

\(^{80}\) Johnson 2015 b.  

\(^{81}\) Johnson 2014 b.  

\(^{82}\) Moore 2014.  

\(^{83}\) Dunai/Anderson 2014.  

\(^{84}\) Moore 2014.  

\(^{85}\) Dunai 2015.
dustry that services many sectors of Russia’s military, including Russia’s newest Su50 PAK/FA fighter aircraft.\textsuperscript{86}

Yet another Russian facility strongly affected by the end of the production symbiosis with Ukraine is the Russian space agency Roscosmos. Ukraine’s advanced space rocket and missile industry (most notably the Yuzhnoye Design Bureau and YushMash production plants in Dnepropetrovsk), makes it „one of the few nations in the world that has a mature space rocket production complex:“\textsuperscript{87}

Located in south-eastern Ukraine’s Dnepropetrovsk, it produced many of the rockets in the early Soviet space program, as well as parts for many missiles and rockets such as Russia’s famous Soyuz, and components for the International Space Station. It also designed, manufactured and today still services Russia’s main intercontinental ballistic missile, the deadly SS18.\textsuperscript{88}

Internal Russian estimates that were leaked to Kommer- sant put the amount of financial resources needed to substitute Ukrainian production lines with Russian indigenous developments at ca. USD 940 million until 2018. Funding this forced import substitution program in the face of plummeting oil prices and a general economic crisis will only be possible by cannibalizing other programs. According to the same report, it is planned to divert funds from the federal space program, from the national defense modernization program, and from state federal investment funding, putting added financial strain on these already strained programs. The estimated necessary timeframe to develop and produce suitable substitutes for all Ukrainian product lines was put at two years by deputy prime minister Rogozin, but defense analysts expect three to five years instead.\textsuperscript{89}

Russia is facing additional problems due to the Western sanctions imposed as a result of the aggression against Ukraine, rendering it effectively unable to find quick alternatives elsewhere. Due to these sanctions, Russia suffers from a general loss of access to key component from NATO and EU states. Vice Premier Rogozin stated that ca. 640 products, in their majority optical and radio electronic components, need to be substituted with indigenous developments as a result of Western sanctions.\textsuperscript{90}

In the light of such dire circumstances, and given pro-Russian sentiments in some parts of Eastern Ukraine, it seems unsurprising that apparently there is illegal smuggling of defense products from Ukraine to Russia. One report related that on the 4th of February 2016, Ukrainian Security Forces intercepted a shipment of microchips apparently bound for Russia in the Volchansky district of the Kharkov region not far from the Donbass area. Although the total value of the shipment was comparatively small at less than USD 7,000, these microelectronic components were nevertheless considered highly valuable to Russia because, according to the report, „there are no analogous substitutes for them manufactured in Russia“ and they are „used in the production of ballistic missile and space launch booster rockets.“ According to the official report, they appear to have been illegally manufactured as well.\textsuperscript{91}

All in all it seems that the quality, not the quantity of the Ukrainian product lines to be hastily replaced through indigenous production by Russia proves the main problem. The magnitude of the difficulties caused by the disruption of supply lines, visible e.g. in the above cited significant delays in naval surface vessel production, seems to indicate that the invasion of Crimea may not have been a Russian long-term plan. Otherwise one could reasonably infer that there should have been attempts to substitute Ukrainian arms imports early on. Looking at the way the Ukraine crisis unfolded through the mil-tech industrial lens, it seems that Russian military industrial planners were only too acutely aware of their own industry’s dependence on Ukrainian products. Had the Ukraine crisis been anticipated long-term, one could assume to see serious attempts at reducing the Russian quasi-dependence by developing a much stronger autarchy in weapons production at the earliest date, at least in the most critical types of technology. Such attempts however don’t seem to be detectable.

If this line of reasoning is correct, the invasion may well have been a hasty and desperate action aiming to prevent the impending loss of access to key facilities on Crimea and in other parts of Eastern Ukraine. In the view of Moore, Russian fears of having military secrets betrayed to Western powers may well have been among the key drivers behind the Russian invasion decision:

For Moscow, the loss of Ukraine to the EU (or worse, to the North Atlantic Treaty Organization as well), would mean the potential

\textsuperscript{86} Moore 2014.  
\textsuperscript{87} Moore 2014. Russian space technology is also highly advanced. The Ukraine crisis caused additional concern in the Pentagon because United Launch Alliance (ULA), a joint venture of Boeing and Lockheed Martin, exclusively relies on Russian-built RD-180 engines to launch the first stage of its Atlas V missiles that are used to launch U.S. military satellites. In March 2014, a U.S. Air Force representative indicated that the existing supply of RD-180’s was sufficient for about two years. Malenic 2014.  
\textsuperscript{88} Moore 2014.  
\textsuperscript{89} Johnson 2014 b  
\textsuperscript{90} Dunai 2015.  
\textsuperscript{91} Johnson 2016 a.
loss of all of this capacity, and the need to replace it rapidly, not to mention the loss of military secrets that could help competitors of the Russian military industrial complex. Ukrainian scientists and engineers know many of Russia’s deepest military secrets, and in fact fathered some of them. 92

Moore also points out that the Eastern regions, where Russian-instigated anti-Kiev violence seems strongest, are located close to key industrial centers of Ukraine’s military-industrial complex – Kharkiv (tank/armor industry), Mykolaiv (shipbuilding), Dnepropetrovsk (space rocket/missile industry) and Zaporizhia (Motor-Sich jet engines). Concludes Moore,

The value and importance of Ukraine’s military industrial complex to Russia is an important reason Moscow will not let go of eastern and southern Ukraine, and consequently it may be that sanctions alone will not be enough to make Putin back down. 93

Another possible interpretation is that the Russian leadership assumed that in the event of a crisis, Russian forces would encounter only minimal armed resistance from Ukraine; and that the annexation of all the Russian-speaking areas within Ukraine was the ultimate goal of the invasion. In that case, the invasion and annexation of Crimea would have been no more than an incomplete step within the framework of a more comprehensive plan aiming to incorporate a much larger portion of Ukraine’s military-industrial complex. This hypothesis in conjunction with the economic crisis would also be able to explain why Russia did not act more decisively to reduce its dependence on Ukrainian technology exports much earlier.

4.3 Implications of the Ukraine crisis for China’s military-industrial development

What could be the possible consequences of the Ukraine crisis from the point of view of China? One measurable effect concerns Russia’s willingness to co-operate more closely. Currently it seems that given the Western sanctions, there are now stronger incentives for Russia than ever before to intensify defense-industrial relations with China, and these have born fruit in the form of a new and unprecedented export and technology transfer agreement for the sale of Lada class submarines, Su-35 aircraft and S-400 air defense missiles. Although this agreement had been under negotiation for years, it only received high-level Russian backing after the Crimea crisis. 94

China meanwhile remains in a position of a twofold dependence toward both Russia and Ukraine due to an effective lack of alternatives. While the defense co-operation with Russia is certainly larger in scope and more strategic in nature than the smaller co-operation with Ukraine, China has fewer areas of rivalry and friction with Ukraine than with Russia, and has been supplied by Ukraine with arguably even more difficult-to-obtain critical technologies than it has received from Russia, among them an aircraft carrier hull, a phased-array radar system prototype, and a local licensed production agreement for naval gas turbines. Nevertheless, China continues to remain dependent on Russian assistance for servicing its fleet of Russian-built submarines and destroyers to the point of maintaining specialized Russian support enclaves, and likely cannot afford to lose this support if these and other systems are to remain serviceable. The new arms deal, if followed through, will cement this type of servicing relationship for decades to come.

A quick breakthrough of China in terms of ascending to a higher tier in the „ladder of production“ in order to gain autarchy in weapons production seems unlikely in the near future. Current reports indicate that China has so far not been successful in its attempts at replacing jet engine imports from Ukraine and Russia with Chinese indigenous developments. 95 This means that China remains so far dependent upon Ukrainian engines e.g. for the Hongdu Aviation L-15 jet trainer. Ukrainian industry sources indicate that there seems to be no substantial progress in China’s indigenous Minshan jet engine development program during the past few years at least. Technical problems that were cited apparently relate to the actual combustion engineering, the hot-section technology and the design of digital control systems. 96

Another indicator for a current lack of engine-design capacity is the above mentioned Chinese decision, officially announced on 19th November, 2015, to import a batch of 24 Russian Su-35 combat aircraft. The deal had been under negotiation at least since 2008 and was concluded under the direct involvement of the Kremlin and of the highest echelon of China’s military leadership. Two

94 After Russia subsequently announced the early termination of its Lada submarine program, Russian officials suggested that China could instead receive the more advanced Kalina class that is to be equipped with an air-independent propulsion system. Cf. Russian and Chinese news report summarized in Keck (2014), and the discussion in „Ejun yanzhi xinxing changgui qianting“ (2015). Schwarz (2017) on the other hand reports a continued Chinese interest in the Lada boats.

95 Schwartz 2017

96 Johnson 2015 b.
components especially seem to be the main driver behind China’s decision to pursue this import: The Russian *Saturn 117S* jet engine and the *NIIP N035 Irbis-E* radar, a passive electronically scanning array (PESA). An unnamed representative of an Ukrainian aerospace company indicated in an interview with Johnson that Chinese specialists seem so far have been unsuccessful when trying to design and manufacture an indigenous PESA, much less and actively electronically scanning array (AESA) with the desired performance.\(^{97}\) The new *Su-35* deal involves a promise of Russia to share the necessary source codes with China’s Shenyang Aircraft Corporation so that Chinese weapons can be integrated in the plane, despite previous Russian allegations that China illegally reverse-engineered the Russian *Su-27* fighter jets.\(^{98}\) China can thus potentially profit from Russia’s current problems by getting more favorable export conditions than before, despite persistent frictions over copyright violations.

As long as the current crisis situation between Russia and Ukraine persists, China could therefore mainly be seen as a profiteer from the vastly changed dynamics between the other two actors in this military-industrial triangle. Russia currently experiences a strong set of incentives to strengthen its strategic co-operation with China in the face of Western sanctions, plummeting oil prices, and grave economic problems that could render Russia’s ambitious military modernization plans rather difficult to realize. Ukraine, on the other hand, needs to replace its formerly sizeable Russian export share with new customers in order to maintain and strengthen its military-industrial complex not least to bolster its defense capabilities, and could thus be especially interested in trying to enhance and use its relations with China (and other countries) – not only as a replacement market for lost Russian orders, but also as a way to exercise political pressure via China on the Russian side. All this could work in China’s favor, and make it possible for China to gain access to more advanced technologies from both sides in the near term.

Should Ukraine however one day opt for much closer integration with the Western powers including in the military realm, then this could ultimately lead to a new situation where Ukrainian mil-tech knowledge becomes gradually less accessible to China due to an incentive to conform with the Western arms embargoes.\(^{99}\) Were that the case, then China’s one-sided dependency on Russian technical support would likely prompt China to strive even harder for more indigenous import substitution, with an aim to achieve a lesser degree of strategic vulnerability. Given the obvious difficulty and complexity of such a task, as can be inferred from the present Russian difficulties substituting Ukrainian components, it seems that this course would almost inevitably have detrimental consequences for the pace of China’s military modernization, especially given that China’s economic situation currently worsens as well.

### 5 Conclusions

The military-industrial symbiosis between Ukraine and Russia came to an abrupt end due to Russia’s forceful intervention and resulting occupation of Crimea. The sudden disruption of defense-industrial ties between two formerly closely interwoven military-industrial complexes now offers analysts the unusual chance to study the nature of transnational arms production arrangements and their strategic implications under crisis conditions. Both sides were forced to quickly substitute goods and services that were previously sourced exclusively from the former partner, and both need to find alternative customers for their products that were previously exported there. In addition, Russia as of early 2017 still faces hefty Western sanctions, and likely continues to fear a leaking through some of its key military-technological secrets to Western rivals, while Ukraine orients itself stronger towards NATO and the EU and tries to forge new defense-industrial partnerships with other countries. The reactions to this and the nature of adjustments made in the coming years by both countries’ arms industries will likely shed even more light on the depth and quality of the previously existing quasi-symbiotic relationship.

Due to the persistence of the U.S./EU arms embargo China effectively remains excluded from trading with any of the leading producers of defense electronics and other advanced weapon system manufacturers. Despite marked progress in developing its indigenous defense-industrial base and military innovation system, there are currently still many indications that China continues to find itself in a partially dependent position vis-a-vis Russia in a number of critical arms projects, China’s greater economic clout notwithstanding. China is therefore under pressure to remedy the situation by furthering its domestic technological innovation capacity, with mixed success so far. Paying especial attention to arms production aspects within the multifaceted Sino-Russian relationship has the potential to explain some of the bilateral political bargaining behavior that seems to run counter to a generally

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97 Johnson 2015 a.

98 Johnson 2015 a.

gressions, and also has to find new customers for its previously Russian-bound export share. There are already indications that Ukraine is in the long run trying to forge stronger military and defense-industrial links with NATO countries, and NATO accession may well be the ultimate goal of Ukraine, having been discussed for years. In that hypothetical case, and given a willingness of NATO to actually entertain such a plan, there would then emerge a new set of incentives for Ukraine of beginning to curb its arms export relationship with China. Such a development would no doubt be seen as detrimental by China, but it remains a remote possibility for the time being.

Dependency in arms production is a potential area of strategic vulnerability, and reducing this strategic risk is therefore likely a priority for any nation in a high or medium threat environment that, like China, finds itself the more dependent partner in a hierarchical arms-producing partnership arrangement, no matter how seemingly stable or durable. On the other hand, such ties can create strong incentives to co-operate in other strategically important realms, and as an outcome of the joint production, they create a basis of military-technological compatibility that can have enhance the ability for military co-operation in case of a crisis. Recently conducted joint maneuvers by China and Russia in the Arctic and in the South China Sea could signal the beginning of a more comprehensive strategic partnership.

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