Global Changes in the Proliferation of Armed UAVs: Risks, Challenges, and Opportunities Facing Israel

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For a number of decades, Israel has been among the leaders in the manufacture, export, and operation of unmanned aerial vehicles (UAVs). This position has given Israel a security advantage and has affected its relations with various countries. In recent years, significant changes have occurred in this sphere, as new manufacturers and exporters, such as China, Iran, and Russia, have appeared, while the United States has changed its export policy. Growing use is being made of civilian technologies and tools, such as drones converted to military use by both countries and terrorist organizations. These changes potentially could have a substantial effect on Israel, both in terms of security and trade. This article reviews the developments that have taken place in the worldwide proliferation of UAVs and recommends a suitable policy for the State of Israel in order to address these changes, including expanding intelligence monitoring of proliferation of UAV systems and components, investing in cyber and electronic warfare systems to counter UAVs, increasing transparency in manufacture and development, and supporting civilian development aimed at entering new markets.

Keywords: UAVs, unmanned systems, drones, military technology

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Introduction

Israel is a major player in the global UAV industry. This is reflected in the development and manufacturing of advanced systems, the accumulation of varied operational experience, and exports of unmanned aircraft. For seven years (2005–2013), Israel was the world's leading exporter in this sphere, despite being a fairly small country.

In recent years, the proliferation of UAVs, including armed UAVs, has changed substantially. This development resulted from the entry of new manufacturers and exporters into the market; a change in the policy of established exporters; and technological developments facilitating the use of various civilian components and products that have been adapted and converted to defense needs. These changes can potentially affect Israel both in terms of security and trade.

This article begins by describing Israel's dominance in the field of UAVs in the past decades and then portrays the changes that have occurred in the proliferation of UAVs in the last decade, including a discussion of the shifting patterns in their use. The article also proposes ways of coping with these changes. In addition to preparing for the security threats posed by this new situation, a change of policy is also needed in the development and production of UAVs in order to maintain Israel's strength in this field.

Israel's Dominance in the Field of UAVS

Israel has been one of the dominant players in the field of UAVs for decades. Israel began using them for photography purposes as early as the 1960s and 1970s, and later for deception and intelligence gathering, notably in Operation Mole Cricket 19 (ARTZAV 19) at the beginning of the First Lebanon War in 1982. Some believe that the success of the UAV activity in this operation inspired continued development of UAVs in the United States in the 1980s and 1990s.[1]

Despite the impressive military operations that featured the early UAVs, Israel's main use of unmanned systems was for ISR as part of its asymmetric warfare, beginning with a series of operations in the early 2000s to the Second Lebanon War, and followed by operations against Hamas (Operation Cast Lead, Operation Pillar of Defense, and Operation Protective Edge) in the

1 Tamir Libel and Emily Boulter, "Unmanned Aerial Vehicles in the Israel Defense Forces," *RUSI Journal* 160, no. 2 (2015): 68–75.

Gaza Strip. Israel's use of UAVs reached a peak in 2006 when it became the first country in history to record more UAV flight hours than manned fighter jets flight hours during a war. Furthermore, it was the first case in military history in which UAVs were continuously used above the battlefield during an entire war.[2]

Israel's leading position and dominance in the field of UAVs is not confined to operational experience. Despite being a relatively small country, Israel was the leading global exporter of UAVs during 2005–2013, with exports totaling $4.62 billion.[3] According to various reports, Israel exported unmanned aerial vehicles to many countries in Europe, Asia, and Latin America,[4] and for many years, Israel also exported UAVs to the United States, which used them in the war in Iraq, among other things.[5] Currently, Israel manufactures and exports various types of unmanned aerial systems on a large scale, including tactical mini-UAVs operated by ground forces, such as Skylark by Elbit Systems;[6] multi-purpose medium-range tactical systems, such as Elbit Systems' Hermes 450, which has a flight range of hundreds of kilometers and is capable of carrying special payloads of approximately 200 kilograms;[7] and long-range UAVs, such as Heron, by the Israel Aerospace Industries' (IAI), which is capable of carrying a special payload of up to 470 kilograms.[8] According to foreign reports, some of the remotely operated Israeli UAVs have advanced attack capabilities.[9]

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2 Isaac Ben-Israel, "The First Israel-Hizbollah Missile War (Summer 2006)," a position paper by the College of Policy and Government, Tel Aviv University, May 2007, p. 46.

3 Ora Coren, "Israel is the World's Largest Exporter of Drones," *The Marker*, May 19, 2013 [in Hebrew], https://www.themarker.com/news/macro/1.2023690.

4 Harriet Sherwood, "Israel is World's Largest Drone Exporter," *The Guardian*, May 20, 2013, https://www.theguardian.com/world/2013/may/20/israel-worlds-largest-drone-exporter.

5 Amnon Barzilai, "U.S. Army Wants to Buy More Israeli Hunter Drones," *Haaretz*, July 8, 2003, https://www.haaretz.com/1.5494046.

6 Skylark™ I – LEX, Elbit Systems website, http://elbitsystems.com/products/uas/skylark-i-lex/.

7 Hermes™ 450, Elbit Systems website, http://elbitsystems.com/products/uas/hermes-450/.

8 Heron, Israel Aerospace Industries website, http://www.iai.co.il/2013/18900-16382-en/BusinessAreas_UnmannedAirSystems_HeronFamily.aspx.

9 Ron Ben-Yishai, "Uncertainty about UAV Attacks Unnecessary," *Ynet News*, July 11, 2016 [in Hebrew], https://www.ynet.co.il/articles/0,7340,L-4826915,00.html.

In addition to these systems, which are flown and operated remotely, Israel also manufactures and exports UAVs in the loitering munitions category, some of which are autonomously operating fire-and-forget systems. These UAVs have technical capabilities that enable them to fly, remain airborne, track a target, and—if necessary—destroy it in a kamikaze mission with explosives they carry. This involves either minimal human intervention, or none at all. Among the prominent systems in this category are Harpy NG and Harop, manufactured by IAI.[10]

Exports of UAVs are one of Israel's important commercial sectors, which, at one point, accounted for about 10 percent of all its defense exports.[11] Beyond its economic importance, exports of UAVs have a major impact on Israel's relations with various countries, both diplomatically and in terms of defense cooperation. Prominent in this framework is Israel's UAV transaction with Russia (to which the United States made no objection), in exchange for which Israel expected Russia to refrain from selling S-300 missiles to Iran.[12]

While for many years, Israel was the leading UAV exporter, the United States also led in producing UAVS and invested considerable resources in manufacturing them in order to increase its own order of battle. In recent years, however, a process has begun in which American UAV manufacturers are seeking to sell such systems to various countries around the world. As a result, this development has intensified global competition, and, above all, competition with Israel. At the same time, additional changes are taking place in the proliferation of military UAVs throughout the world, as described below. These changes are also likely to affect Israel.

A Change in the Proliferation of Military UAVs

The global UAV market has grown substantially from year to year. The market, which was estimated at $5.93 billion in 2015, is projected to reach $22.15 billion in 2022. Although the military sector of the market will

10 Harpy NG, Israel Aerospace Industries Website, http://www.iai.co.il/2013/36694-16153-en/Business_Areas_Land.aspx.

11 Coren, "Israel is the World's Largest Exporter of Drones."

12 Anshel Pfeffer, "Israel to Sell UAVs in Exchange for Canceling Deal with Iran," *Haaretz,* June 25, 2009 [in Hebrew], https://www.haaretz.co.il/news/politics/1.1267820.

grow, most of the market growth will be in the civilian sector.[13] Despite the global changes, Israel and the United States are still the two leaders in manufacturing and exporting military UAVs. Technological innovations, together with the effects of globalization and the absence of regulation, have caused significant changes in this field and have facilitated the appearance of new players in the UAV market.[14] The new players are offering their wares in new markets, including countries to which formerly no party was willing to sell systems of this type.

This development has led to significant changes in the proliferation of UAVs in general and armed UAVs in particular, as well as in the patterns of their use. This matches the forecast made a number of years ago by the RAND Corporation, which forecasted that within a decade, every country would be able to purchase and employ armed UAVs.[15] Based on the RAND Corporation's study and the changes that have taken place since it was published, it can be argued that the most significant change in the UAV sector today is taking place in the armed UAV sub-sector.

China is one of the important players that has entered the armed UAV export market in the past decade and has caused fundamental changes to it. According to a 2015 report by the US Department of Defense, China plans to manufacture 42,000 various types of UAVs by 2023,[16] while more recent reports state that China continues to invest resources in this field in order to

13 Christopher Diamond, "Global Drone Market Expected to Surpass $22B by 2022," *Defense News*, May 3, 2017, https://www.defensenews.com/air/2017/05/03/global-drone-market-expected-to-surpass-22b-by-2022/.

14 Liran Antebi, "Changing Trends in Unmanned Aerial Vehicles: New Challenges for States, Armies, and Security Industries," *Military and Strategic Affairs* 6, no. 2 (August 2014), http://www.inss.org.il/publication/changing-trends-in-unmanned-aerial-vehicles-new-challenges-for-states-armies-and-security-industries/.

15 Lynn E. Davis, Michael J. McNerney, James S. Chow, Thomas Hamilton, Sarah Harting, and Daniel Byman, *Armed and Dangerous? UAVs and U.S. Security* (Santa Monica: RAND Corporation, 2014), https://www.rand.org/pubs/research_reports/RR449.html; Patrick Tucker, "Every Country Will Have Armed Drones Within 10 Years," *Defense One*, May 6, 2014, https://www.defenseone.com/technology/2014/05/every-country-will-have-armed-drones-within-ten-years/83878/.

16 Zachary Keck, "China Is Building 42,000 Military Drones: Should America Worry?," *National Interest*, May 10, 2015, https://nationalinterest.org/blog/the-buzz/china-building-42000-military-drones-should-america-worry-12856.

carry out its plan.[17] Chinese Cai Hong (CH) Rainbow UAVs, manufactured by China Aerospace Science and Technology Corporation (CASC),[18] have been widely distributed throughout the world over a few years time. Notable among this series are the CH-3, the most common model, and the CH-4. Both have offensive capabilities but differ in size, payload capacity, and duration of flight. The manufacturer claims that the CH-5, the newest UAV of this series, can carry payloads and weapons weighing up to 1,000 kilograms, with sixty hours endurance, and has a maximum flight range of 6,500 kilometers.[19] These figures are an attempt to compete with advanced UAVs made by countries that have a great deal of experience in this field.

Simultaneously with its rapid technological and production development, China practices a very permissive and liberal export policy, in contrast to the conservative policy of the United States and Israel. For one, China has not signed agreements such as the Missile Technology Control Regime (MTCR), which restricts UAV exports. The Chinese also offer a variety of their UAVs at significantly lower prices than the Americans do, which makes China an attractive exporter. For example, a Chinese CH-5 UAV costs almost half the price of an American MQ-1 Predator UAV.[20] As a result, Pakistan, Iraq, and Nigeria have already conducted attacks using armed UAVs supplied to them by China or manufactured with its cooperation. As of 2018, China has approved UAV exports to ten countries, including Jordan, Saudi Arabia, and the United Arab Emirates.[21] This Chinese policy affects Israel both in terms of security and trade.

Another player causing change in the global UAV market is Iran. In recent years, Iran has been manufacturing various types of UAVs, displayed

17 US Department of Defense, "Annual Report to Congress, Military and Security Developments Involving the People's Republic of China 2018," May 16, 2018, pp. 23, 33–34, 63–64, 83, https://media.defense.gov/2018/Aug/16/2001955282/-1/-1/1/2018-CHINA-MILITARY-POWER-REPORT.PDF.

18 China Aerospace Science and Technology Corporation (CASC), http://english.spacechina.com/n16421/index.html.

19 Zhao Lei, "Unmanned Combat Drone to be Exported," *China Daily*, January 11, 2016, http://www.chinadaily.com.cn/china/2016-11/01/content_27233618.htm.

20 Ben Brimelow, "Chinese Drones May Soon Swarm the Market – and That Could Be Very Bad for the US," *Business Insider*, November 16, 2017, https://www.businessinsider.com/chinese-drones-swarm-market-2017-11.

21 "World of Drones," *New America*, https://www.newamerica.org/in-depth/world-of-drones/1-introduction-how-we-became-world-drones/.

publicly on different occasions, although some of the models that Iran has displayed at exhibitions or in military parades do not have any operational capability. Up until recent years, it appeared that the Iranian-made UAVs were for use by its allies and protectorates, such as Hezbollah.[22] In the past two years, however, Iran apparently also began supplying UAVs to Syria, a failed country engaged in a civil war for over five years. This new development is a game changer for Israel.

One of the main systems used by Iran and its allies is the Shahed 129, which, among other things, was used to attack the rebels in Syria.[23] Iran has been offering a UAV called Hamaseh since 2017, which UAV scholars say is reminiscent of IAI's Heron TP (although its dimensions are smaller).[24] According to the Iranian reports, this UAV is capable of carrying advanced munitions and sensors, with endurance of eleven hours, and has a maximum flight range of 200 kilometers. The Iranians also claim that this UAV has stealth capabilities, although its external form and the way its munitions are mounted indicate otherwise.[25] As Iran does not have any military satellites, its ability to operate UAVs is therefore limited, because the transmission ranges of its UAVs are limited to relatively short distances. In other cases, the intelligence information that they gather can be transmitted only after they land.[26]

Together with the changes in proliferation of UAVs resulting from the new players entering the market, the United States—an established manufacturer of UAVs—is also likely to begin changing its policy on UAV exports, especially

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22 Roi Kais, "Hezbollah Has Fleet of 200 Iranian-made UAVs," *Ynet,* November 25, 2013, https://www.ynetnews.com/articles/0,7340,L-4457653,00.html.

23 Jeremy Binnie, "Analysis: Syrian Rebel Video Corroborates Iranian UAV Strike Claims," *Jane's 360*, February 12, 2016, https://www.janes.com/article/57968/analysis-syrian-rebel-video-corroborates-iranian-uav-strike-claims.

24 Stephan Trimble, "Iran Puts Hamaseh UAV on Export Market," *FlightGlobal*, July 18, 2017, https://www.flightglobal.com/news/articles/iran-puts-hamaseh-uav-on-export-market-439414/.

25 Kelsey D. Atherton, "Iran Unveils Absurd New Stealth Drone," *Popular Science*, May 13, 2013, https://www.popsci.com/technology/article/2013-05/iran-unveils-new-stealth-drone-isnt.

26 Yaniv Kubovich, "Iran's Army of Drones, Target of Syria Strike: Rising Force or Limited Threat?," *Haaretz*, April 12, 2018, https://www.haaretz.com/middle-east-news/iran/.premium.MAGAZINE-iran-s-drones-targeted-in-syria-rising-force-or-limited-threat-1.5992631.

armed UAVs, and it will follow the example of those countries affecting the changes in the worldwide proliferation of UAVs. It was reported that President Trump, in contrast to his predecessor, was considering to change US export policy on unmanned systems. In the framework of the new policy, the barriers preventing the sale of small UAVs will reportedly be lowered for those with strike-enabling technology that have ranges and weapons payload capacities inferior to those of the veteran MQ-1 Predator UAV[27] or the MQ-9A Reaper, the more advanced model. The demand to lower the barriers to the sale of UAVs comes from the American defense industries, which seek to expand their circle of customers. Others in the United States oppose this change in policy, because, in part, they claim that increased sales of offensive UAVS are liable to give weapons to governments that take irresponsible actions against their neighbors and also against their own populations.[28]

Another country that seeks to become a more significant player in the field of the UAVs is Russia. Compared to its military power and the role its military exports play in its strategic relations with many countries, Russia is relatively backward in the field. Nonetheless, Russia is generally regarded as one of the five leading countries in the UAV field,[29] likely because of its efforts to invest resources in a national UAV development program costing billions of dollars.[30] Russia is also pursuing cooperation in UAV production with various other countries with which it previously had such cooperation.[31] Russia is still technologically and industrially backward in this field, but its

27 Michael C. Horowitz and Joshua A. Schwartz, "A New U.S. Policy Makes it (Somewhat) Easier to Export Drones," *Washington Post*, April 20, 2018, https://www.washingtonpost.com/news/monkey-cage/wp/2018/04/20/a-new-u-s-policy-makes-it-somewhat-easier-to-export-drones/?utm_term=.2f0fe76beefb/.

28 Mike Stone and Matt Spetalnick, "Exclusive: Trump to Boost Exports of Lethal Drones to More U.S. Allies – Sources," *Reuters*, March 18, 2018, https://www.reuters.com/article/us-usa-arms-drones-exclusive/exclusive-trump-to-boost-exports-of-lethal-drones-to-more-u-s-allies-sources-idUSKBN1GW12D.

29 Robert Farley, "The Five Most Deadly Drone Powers in the World," *National Interest*, February 16, 2015, https://nationalinterest.org/print/feature/the-five-most-deadly-drone-powers-the-world-12255.

30 Jaroslaw Adamowski, "Russian Defense Ministry Unveils $9B UAV Program," *Defense News*, February 19, 2014.

31 Yaakov Lappin, "Report: Moscow Purchased 10 Israeli Drones," *Jerusalem Post*, September 8, 2015, https://www.jpost.com/Israel-News/Politics-And-Diplomacy/Report-Russia-purchased-ten-Israeli-drones-415575.

growing activity requires special attention, especially given that it supplies military equipment to recalcitrant countries like Syria.

Parallel to these changes and forming a prominent trend, many countries have become UAV manufacturers, usually for their own consumption. Even though most of the UAVs being manufactured are not offensive, the potential effect of this change on both defense and trade cannot be ignored. These relatively new manufacturers include India, Pakistan, South Africa, Venezuela, and Ukraine, but many more countries can be mentioned in this context.[32]

Given the global changes taking place in the field of UAVs, several initiatives aimed at limiting or changing the existing situation have been launched. A study by the United Nations Institute for Disarmament Research (UNIDIR) calls for greater transparency, monitoring, and legal liability for armed UAVs. The study, based on meetings with experts in different fields and from various countries, includes a series of recommendations, the most important of which is conducting an open and joint multilateral discussion for the purpose of setting standards and principles for the use of armed UAVs.[33] In addition, the United States launched an initiative in 2016, in which it drew up a document of principles for regulating UAV exports. Although forty countries have signed the document to date, France, Russia, China, and Brazil are among the important manufacturers who refused to sign the document, in addition to Israel, which is concerned that the document will restrict its global business activity in this sphere.[34]

The Change in the Patterns of Using Armed UAVs

The change in the proliferation of UAVs facilitates, among other things, a shift in the patterns of their use, especially in the use of offensive UAVs. The majority of the shift in the use of UAVs in recent years has occurred in the

32 Wim Zwijnenburg and Foeke Postma, "Unmanned Ambitions: Security Implications of Growing Proliferation in Emerging Military Drone Markets," (Utrecht: Pax for Peace, 2018), pp. 18–35, https://www.paxforpeace.nl/publications/all-publications/unmanned-ambitions.

33 UNIDR, "Increasing Transparency, Oversight and Accountability of Armed Unmanned Aerial Vehicles," (2017), http://www.unidir.org/files/publications/pdfs/increasing-transparency-oversight-and-accountability-of-armed-unmanned-aerial-vehicles-en-692.pdf.

34 Gili Cohen, "Israel Refuses to Sign US Document Regulating Attack Drones," *Haaretz,* October 23, 2016 [in Hebrew], https://www.haaretz.com/israel-news/.premium-israel-won-t-sign-u-s-document-regulating-attack-drones-1.5452346.

Middle East, a region rife with violent conflicts. One prominent example is in the case of the Iraqi army's struggle against the Islamic State (ISIS) terrorist organization. The Iraqi army, which had been dismantled and rebuilt by the United States following the Second Gulf War, almost collapsed again under severe attack by ISIS; however, the Iraqi army currently possesses armed Chinese-made UAVs that have strike capabilities using guided missiles. These systems enable it to join a growing number of armies around the globe making operational use of armed UAVs, which, until less than a decade ago, had been limited to only a few countries. The case of Iraq is particularly disturbing, given the instability prevailing in that country in general and in the Iraqi army in particular.

According to a study by the PAX organization, new UAV manufacturers, such as Iran, supplied UAVs—some of them armed—to various countries for their use. Iranian-made UAVs have been used in a number of regional conflicts and clashes, including in Turkey, the Persian Gulf, and Syria, as well as in Pakistan, where Iranian-made UAVs were used against the rebels in northwestern Pakistan.[35] The ability of these countries to buy and use UAVs is disturbing, especially given the nature of their regimes, their instability, and the terrorist threats associated with them.

Another case in which offensive UAVs were used in the Middle Eastern theater is the Iranian UAV that Syria launched at Israel in February 2018. This UAV, which various sources assert is a copy of a US stealth UAV, having the capacity to carry precise missiles, was intercepted by Israel.[36] According to an inquiry conducted and published by the Israel Defense Forces, the UAV carried explosives, making its launch the first case in which Iran tried to directly attack Israeli territory.[37]

Beyond the use of the UAVs manufactured by the military industries of various countries, improvised armed weapons and converted civilian devices are now also being employed. Even though these devices were not produced

35 Zwijnenburg and Postma, "Unmanned Ambitions," p. 11.

36 Morris Loveday, "The Drone Shot Down by Israel was an Iranian Copy of a U.S. Craft, Israel Says," *Washington Post*, February 11, 2018, https://www.washingtonpost.com/world/israel-confirms-downed-jet-was-hit-by-syrian-antiaircraft-fire/2018/02/11/bd42a0b2-0f13-11e8-8ea1-c1d91fcec3fe_story.html?utm_term=.8ab82fb83acf.

37 Yoav Zitun and Ron Ben-Yishai, "The Explosive UAV: First Iranian Attempt to Attack Israel Directly," *Ynet* April 14, 2018 [in Hebrew], https://www.ynet.co.il/articles/0,7340,L-5229485,00.html.

for military purposes and are often small and have short ranges and little accuracy, they can still pose a significant security threat.[38] One prominent case in this context occurred in December 2017, when Khmeimim, a Russia air force base in the Latakia district, and Tartus, a logistics center, both in Syria, were attacked by a group of thirteen UAVs, causing substantial destruction to Russian army equipment: bombers, warplanes, cargo planes, and ammunition stores. The technology used by the attackers in their improvised devices, including GPS systems used for the precise attack, led Russian sources to claim that a developed country was behind the attack;[39] however, no concrete evidence of this allegation was found. Some scholars assert that sub-state organizations are also now capable of producing weapons like those used in the attack, using components that can be purchased commercially or self-produced. A few days after the first attack on Russian targets in Syria, known as the Novy God attack, the Russian army successfully thwarted another attempted attack against the Khmeimim base using armed UAVs.[40] Since then there have been additional attacks against the base, with the Russian air defense systems successfully intercepting the attack UAVs.[41]

The significance of these attacks is that UAV technology is now widely distributed, and the main threat to Israel comes not only from countries buying Iranian or Chinese attack UAVs but also from any group capable of assembling advanced attack devices from commercially available components. State intelligence organizations find it difficult to track such groups. This new threat is growing and becoming stronger as a result of the expanding proliferation of various types of advanced technologies. This creates an off-the-shelf supply of devices that can be used for deadly purposes without great difficulty. In this manner, various technologies have become dual use (civilian and military), even though they are not classified as such and

38 "Home-Made Drones Now Threaten Conventional Armed Forces," *Economist*, February 8, 2018, https://www.economist.com/science-and-technology/2018/02/08/home-made-drones-now-threaten-conventional-armed-forces.

39 Dave Majumdar, "Russia Came Under Attack by a 'Swarm' in Syria, Says Report," *National Interest*, January 8, 2018, https://nationalinterest.org/blog/the-buzz/russia-came-under-attack-by-swarm-syria-says-report-23987.

40 News agencies, "Russian Base in Syria Again Under Attack: 'Armed UAV Attack Thwarted'," *Walla News,* January 7, 2018, https://news.walla.co.il/item/3125331.

41 Dmitry Kozlov and Sergei Grits, "Russia Says Drone Attacks on its Syria Base Have Increased," *Times of Israel*, August 17, 2018, https://www.timesofisrael.com/russia-says-drone-attacks-on-its-syria-base-have-increased/.

are consequently not restricted by regulation or legislation that limits their distribution and prevents their use for military purposes. This constitutes a substantial threat to Israel, because the terrorist organizations that pose the threat rely on these technologies more than regular armies do.

The UAV attacks in Syria once again also highlight the threat of drones, which many countries are not prepared to face—neither in their deployment of air defense systems around bases and strategic assets, nor in electronic warfare or cyber capabilities for jamming or gaining control over hostile remote-controlled devices. The damage caused by improvised devices like the one used in the attacks against Khmeimim, or by an armed drone attack, does not have a strategic effect on a country or a military system in most cases, but they are liable to cause severe cognitive damage.

Possible Effects on Israel

The changes taking place in the field of UAVs affect the entire international arena. Armed UAVs have provided various groups greater capability, more than in the past, of carrying out aerial attacks without taking responsibility for them, while maintaining secrecy about the source of the attack. The ability to carry out ISR missions has also shifted significantly as a result of the change in risk management by commanders or politicians, due to the fact that these aircraft have no human operator on board. The growing competition in the UAV market is an additional factor that substantially affects other countries, especially those that were formerly leading manufacturers and exporters in this area.

The effect of these changes on Israel is greater than in other countries in both the defense and trade sectors. This is due to Israel's standing as a leading exporter of unmanned aerial systems, the effect of the proliferation of UAVs on strategic questions of concern to Israel, and the range of ongoing security threats against it from both neighboring countries and terrorist organizations operating both inside and outside Israel's borders. The changes in the UAV industry and their principle effects on Israel are discussed below.

Security Threats

The wide range of UAV manufacturers and exporters, including offensive UAVs, changes the nature of the potential users of these systems. The fact that countries that previously were unable to purchase UAVs (because of both the

cost and those countries' strategic relations) are now able to purchase them from China and use them is liable to pose a challenge to Israel in the near or medium-term future. The risk posed by the possibility of these systems moving from those countries into the hands of non-state groups should also be taken into account. The relevant countries in this context include Iraq, Jordan, Pakistan, and Iran, in addition to Hezbollah, which is equipped with Iranian systems.

It should be noted that this change comes in addition to other transformations in the Middle East, including the unstable situation in Syria over the past decade and the Russian and Iranian presence, which both affect Israel and create threats that it must face. To this should be added the aerial threat resulting from the use of drones and improvised weapons, plus the fact that various players are able to obtain significant aerial capabilities through commercially available off-the-shelf components. These capabilities include attack UAVs and improvised precise aircraft for use in suicide missions.

Commercial Challenges

The commercial challenges to Israel resulting from the proliferation of UAVs is a difficult one. Israel needs defense exports, of which UAVs constitute an important share, in order to advance large-scale activity by Israel's defense industries, since the Israeli market is too small to sustain those industries by itself. In addition, Israel's UAV exports are affected by global changes in the proliferation of unmanned aircraft, especially the Chinese UAV exports, which constitute significant commercial competition.[42] In contrast to the United States, however, which also suffers from Chinese competition, Israel is more exposed to international criticism for its use of UAVs, which is also liable to affect its manufacturing and export capacities.[43] Furthermore, in contrast to the United States, which can respond to competition from China and Israel by expanding its UAV exports to countries like Saudi Arabia,[44]

42 "Israeli UAV Manufacturers Fear Chinese Threat," *The Marker*, February 10, 2018 [in Hebrew], https://www.themarker.com/wallstreet/1.5806899.

43 Damien Gayle, "Charges Dropped over Protest at Israeli Military Drones Factory in UK," *The Guardian*, November 23, 2017, https://www.theguardian.com/world/2017/nov/23/charges-dropped-protest-israeli-military-drones-factory-uk-uav-engines.

44 Dan Arkin, "US to Supply Medium-Range Armed UAVs to Saudi Arabia, South Korea, and Japan," *Israel Defense*, March 26, 2018 [in Hebrew], http://www.israeldefense.com/he/node/33573.

Israel's export market is more limited, since it faces more difficulty than others in exporting UAVs to countries with which it has no official diplomatic ties.

Israel's exports, particularly the UAVs, are also affected by the defense export agreements. One prominent agreement is the Missile Technology Control Regime,[45] the supervisory regime for missile technologies, in which the member countries coordinate their policies of supervising exports in this sector. Since 1991, Israel has acted in accordance with this agreement and has applied it in countries to which it exports UAVs.[46] At the same time, as with other international agreements, Israel finds it difficult to have any influence on the occasional revisions made to the agreement, which have a greater commercial effect on it than on the United States as well as on countries that did not sign the agreement or do not comply with its provisions.

Both the defense and commercial challenges require Israel to revise its policy on UAVs in order to be suitably prepared for the risks of hostile operation of UAVs by Israel's enemies and to preserve its ability to export unmanned aircraft to various countries and to enjoy the economic and diplomatic benefits that it confers.

Recommendations for Israel

Given the changes described above, Israel must consider hostile operation of UAVs, drones, and improvised weapons as possible aerial threats by the countries that are its enemies. This has already occurred when UAVS were launched by Hezbollah in Lebanon toward Israel and from Syria, operated by Iran. Israel must also prepare to intercept and respond even in cases when weapons are used against it without any group taking responsibility for their launching. In addition, Israel should be aware of the risks involved in the proliferation of UAVs and should prepare technologically and operationally to address the small and medium-sized risks from unmanned aircraft that are likely to be utilized in a group or in a barrage.

Israel should devote intelligence efforts to tracking the worldwide proliferation of UAVs, including armed UAVs made by China, Iran, and other countries in the Middle East arena. In addition, it should monitor off-the-shelf products and components, as well as dual-use technologies likely

45 The Missile Technology Control Regime website: http://mtcr.info/.

46 The website of the Israeli Defense Export Controls Agency, http://www.exportctrl.mod.gov.il/Hakika/Pages/MTCR.aspx.

to help produce improvised unmanned aircraft. A thorough understanding of the global UAV map, combined with monitoring exports and the transfer of weapons between countries and between sub-state organizations, is an important element in preparing to defend Israel's skies and its forces in routine and war times.

Simultaneously, Israel should invest in developing cyber and electronic warfare systems, while adapting its air defense systems to threats from UAVs. The aim is to create cheaper responses than missile interception through remote jamming or disabling of hostile UAVs, for example. Israel also needs effective means for dealing with the multiplicity of large-scale threats, including groups and swarms of UAVs and drones.

Israel should assume that this trend will continue to mount and affect the international arena. It is therefore recommended that the State of Israel encourage the defense industries to invest in developing air defense solutions against UAVs of various sizes and types. One example is the transaction signed by Rafael Advanced Defense Systems with the United Kingdom for exporting systems against drones.[47] This system is likely to form an important export commodity in its own right, which will provide a response to a growing global challenge, while also aiding in the defense of Israel's security.

Investing in the development of means of defense against UAVs is also crucial because of the civilian use of UAVs, which is likely to expand greatly in the coming decades. This development will pose challenges not only to air defense but also to the air traffic management in any country that wishes to remain on the technological cutting edge and facilitate the operation of such systems in its territory for commercial and private needs, as well as those of the state itself.

In order to preserve exports, which helps to aid in the development of new systems, Israel should emphasize its other advantages and not just the technology. In this framework, Israel can also offer services to various countries and—more importantly—knowledge based on its operational experience and high quality personnel, as it did in its transaction of UAVs with Germany. This transaction includes nine-year leases (in contrast to purchasing) for Israeli Heron TP UAVs made by IAI Germany's military

47 Yuval Azulai, "Rafael to Sell 6 Anti-Drone Systems to UK for $20m," *Globes*, August 16, 2018, https://en.globes.co.il/en/article-rafael-to-sell-6-anti-drone-systems-to-uk-1001250393.

forces. In this framework, German teams will also be trained in Israel to operate the UAVs.[48] This method will make it possible to preserve strategic partnerships and create new ones.

Israel's strategic relations with India, which is significantly affected by the export of military technology, including advanced UAVs, is another example.[49] These relations indicate that exports of UAVs are more important than just the revenue generated. Israel should therefore continue investing in technological innovation and in the ability to provide solutions for the operational and technological needs of its clients, while manufacturing and exporting on relatively short timetables. In doing so, Israel will maintain other advantages beyond the prices of its products, which are not cheap in comparison to China or other competitors. Israel should also consider the possibility of providing support and sharing operational knowledge as part of the service for its clients, an advantage that many of its competitors are unable to offer.

Despite the growing competition in the international arena due to new players in the market and increased efforts by veteran players like the United States to expand their sales, Israel should carefully select the countries and regimes to which it exports military technologies, including UAVs, as it has done until now through the Israeli Defense Export Controls Agency (DECA). It should continue to do so even as new systems enter the market, such as civilian drones that provide a response to some of the existing military needs and do not require the use of military UAVs, or even constitute weapons in the hands of terrorist organizations.

Given the difficult competition in the military UAVs sector and the harsh criticism accompanying it on the one hand, and the huge economic potential in the civilian UAV market on the other,[50] Israel should consider increasing state investments in developing and manufacturing technologies for civilian needs, based on the relative advantage and knowledge that it has accumulated in the field of military UAVs. By this, the state will support

48 Assaf Uni, "Bundestag Approves €1b Israeli UAV Deal for German Army," *Globes*, June 13, 2018, https://en.globes.co.il/en/article-bundestag-approves-%E2%82%AC1b-israeli-uav-deal-for-german-army-1001241320.

49 Manu Pubby, "India all Set to get Missile Armed Drones from Israel," *Economist Times*, July 14, 2018, https://economictimes.indiatimes.com/news/defence/india-all-set-to-get-missile-armed-drones-from-israel/articleshow/57980098.cms.

50 Diamond, "Global Drones Market Expected to Surpass $22b by 2022."

the creation of another important export commodity, which is likely to also become a key source of revenue and an incentive for strategic partnerships with additional countries.

Israel should continue monitoring developments in the UAVs debate in the international arena, primarily in the various UN agencies, and try to utilize diplomatic means to prevent restrictions from being imposed on Israel in this field. Israel should also consider increasing its level of transparency regarding some of its own use of UAVs in order to avoid international criticism and its effects, including any politically motivated efforts by countries at the UN to restrict the use of attack UAVs, thereby damaging Israeli exports. Greater transparency will make it possible to ratify and validate the fact that Israel uses UAVs in accordance with the prevailing norms and international law, as well as to prevent attacks against it by human rights organizations and various countries. Increased transparency also may help portray Israel's capabilities in a positive light, which can also generate demand for those capabilities among other countries in the world.

Conclusion

Israel is one of the world's leading UAV exporters, and it is also one of the most prominent users of these systems and has many years of experience in operating them. Israel has faced challenges in recent years due to changes in the global proliferation of UAVs both in technological terms and due to the entry of new players into the market and a change of policy by veteran players. These developments pose a stiff challenge to Israel in terms of trade. Furthermore, the global proliferation of UAVs and the new aerial threats that these systems pose are a security challenge for Israel.

This article described Israel's dominance in the UAV sector, especially since the beginning of the twenty-first century, and the changes that have occurred over the past decade in the proliferation of UAVs throughout the world and in their use. The fact that China has become a major exporter and has a permissive export policy has caused far-reaching transformations in the entire international arena that also affect Israel. The challenges posed by Iranian UAVs and the extensive use of UAVs in the unstable Middle Eastern arena were also raised here. In addition, the entry of new players into the unmanned aircraft sector and the change in policy among veteran players in this area, such as the United States, poses trade threats to Israel.

Israeli policy can and should be adjusted to the changes taking place in the UAV sector. In this framework, this article proposed a series of measures: worldwide intelligence tracking of the spread of UAVs and their components, development of cyber and electronic warfare systems for countering the UAV threat, and adapting and upgrading Israel's air defense systems to deal with the new threats. It is also recommended that Israel step up its level of transparency with respect to UAVs, while at the same time it should carefully select the parties to whom it exports weapons. Israel should also consider additional ways to preserve and even increase its exports of unmanned aircraft. It should maximize the strategic achievements made possible by these exports and simultaneously consider the possibility of encouraging Israeli industries to develop UAVs for civilian needs and defense systems against UAVs due to the enormous economic potential in these markets and as part of the goal of preserving Israel's strength and security.