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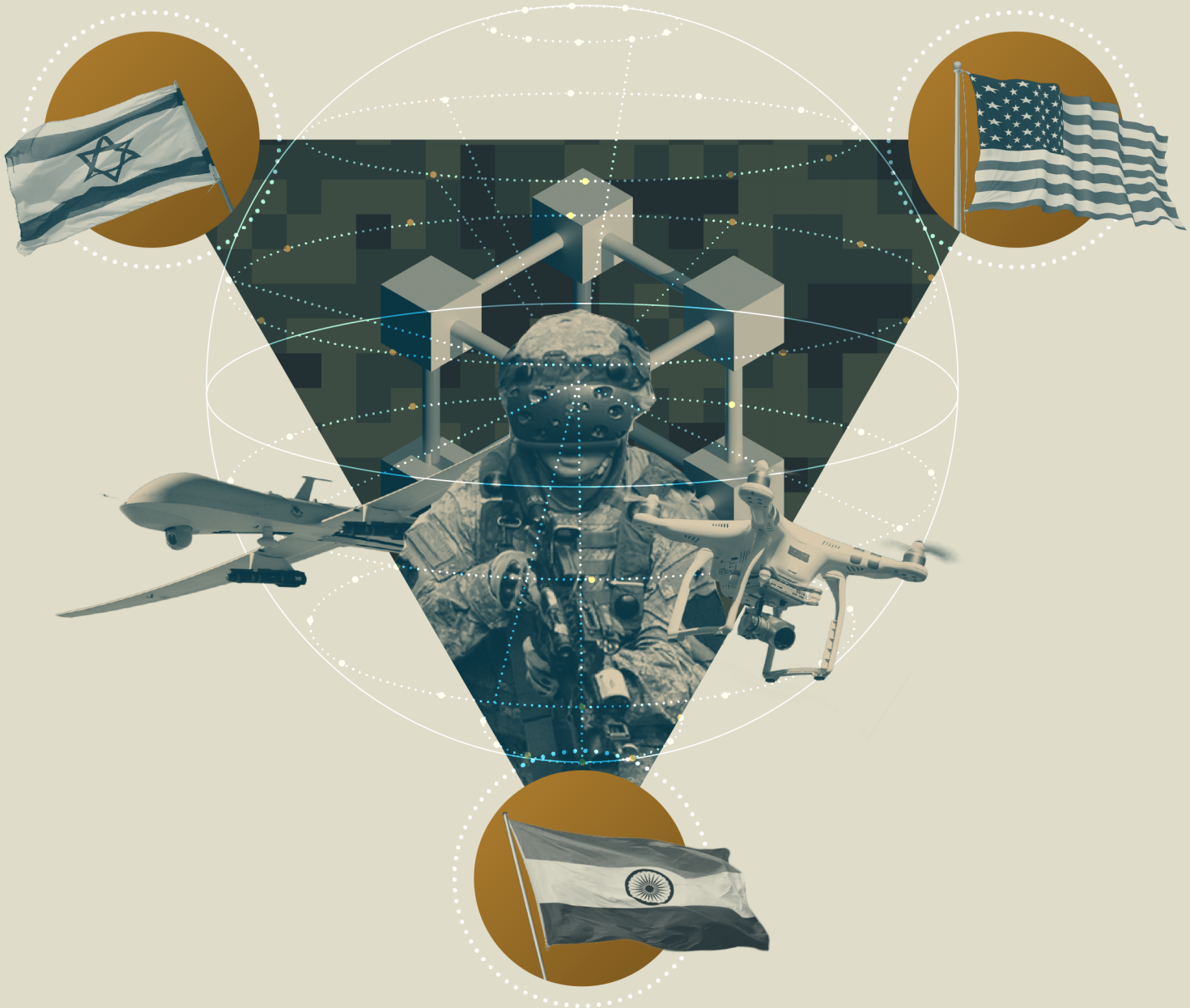
Inserting India into U.S.-Israel Defence Technology Cooperation

by **Sameer Patil,** Fellow, International Security Studies Programme



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Research assistance by **Kunal Thakkar**

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About the Author

Sameer Patil is Fellow, International Security Studies Programme, Gateway House. Prior to this, he was Assistant Director at the National Security Council Secretariat in the Prime Minister's Office, New Delhi, where he handled the counter-terrorism and regional security desks. Sameer has written extensively on various aspects of national security, including counter-terrorism, cybersecurity, the Kashmir issue, India-Pakistan and India-China relations.

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List of Abbreviations

AI	Artificial Intelligence
DIU	Defense Innovation Unit
DRDO	Defence Research and Development Organisation
DTTI	Defence Technology and Trade Initiative
G20	Group of 20
IAI	Israel Aerospace Industries
iDEX	Innovations in Defence Excellence
IDF	Israel Defense Forces
MNNA	Major Non-NATO Ally
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle

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1. Introduction

Technology has become the main driver of contemporary international relations, defining politics, security and economics. It has become a vital part of the global agenda in multilateral forums like the Group of 20 (G20) nations. It is also shaping emerging potential alliances, as is evident from the discussions surrounding the U.K. Prime Minister Boris Johnson's proposed "D-10"(a coalition of ten democracies to create an alternative supply chain of 5G and other emerging technologies[1]) or a similar proposal by two former U.S. State Department Officials—Jared Cohen and Richard Fontaine—to bring together the "T-12" group of techno-democracies (countries with top technology sectors, advanced economies, and a commitment to liberal democracy).[2] Keeping up with this broader trend of technology-based partnerships, India, Israel, and the U.S. can carve out a trilateral cooperation focusing on defence technology. Such potential collaboration will capitalise on the existing robust bilateral defence and security cooperation amongst the three countries. It also promises to give a technological edge to their militaries, develop interoperability, and provide opportunities for exports.

This report studies the potential of such a trilateral defence technology partnership and identifies opportunities and challenges for initiating it. After discussing the rationale for such cooperation, it reviews the existing bilateral defence cooperation between the three countries, focusing on the co-development of technologies. Following this, the report examines the defence innovation base and start-up ecosystems in Israel, the U.S., and India; and identifies emerging technologies for initiating this cooperation. The report concludes by recommending steps to develop this partnership.

1 Lucy Fisher, "Downing Street plans new 5G club of democracies", The Times, May 29, 2020, https://www.thetimes.co.uk/article/downing-street-plans-new-5g-club-of-democracies-bfnd5wj57.

2 Jared Cohen and Richard Fontaine, "Uniting the Techno-Democracies: How to Build Digital Cooperation", Foreign Affairs 99, no. 6, (November/December 2020): 112-122.

2. Imperative for a Trilateral Defence Technology Partnership

Despite its flourishing technological-industrial innovation base, the U.S. is now confronted with the reality that it no longer enjoys the absolute lead in many emerging technologies, especially in the defence sector such as drones, robotics, artificial intelligence (AI), and quantum computing. Its principal adversaries, China and Russia, have pursued the same set of technologies to reduce their capability gap with the U.S. and attain competitive advantage. In 2017, Russian President Vladimir Putin had declared that the country which takes the lead in AI will rule the world.[3] China has identified these technologies as strategic technologies and anchored its flagship national policies such as "Made in China 2025" industrial strategy on them.[4] In the Chinese Communist Party's conception, these technologies are multi-use, which blurs the distinction between civil and military, thereby allowing the Party to utilise these technologies not just for national governance and industry, but for defence and security as well. Beijing has also joined hands with Moscow to collaborate and innovate on these technologies.[5]

China's confrontationist attitude against its neighbors and adversaries— as seen in the ongoing border standoff with India in Ladakh—coupled with its determined efforts to take the lead in emerging technologies, make it imperative for India, the U.S. and other like-minded countries to bolster their existing research and development activities in such technologies. Though technological advancements are taking place at breakneck speed, it is clear that a solo national effort in developing and adopting critical technologies won't go far.

Therefore, India and the U. S. need to expand their effort and enlist another close partner, Israel, to advance their technological goals.

The financial logic of such an effort becomes even more apparent in the face of the challenge of a once-in-a-century pandemic of COVID-19, which has strained economies and resource mobilisation, and distracted many countries from their strategic goals. If such cooperation is undertaken, it will enable cost-sharing for innovation, leading to optimal use of finite budgetary resources and achieving economies of scale.[6]

3 Tass, "Putin stresses whoever takes the lead in artificial intelligence will rule world", September 1, 2017, https://tass.com/society/963209.

4 Oliver Corff, "Rich Country, Strong Army": China's Comprehensive National Security, Federal Academy for Security Policy Working Paper No. 17/2018: 2.

5 Mo Jingxi, "Xi, Putin salute opening of science, innovation year", China Daily, August 27, 2020, https://www.chinadaily.com.cn/a/202008/27/WS5f462cb5a310675eafc55aee.html. & Samuel Bendett and Elsa Kania, "The resilience of Sino-Russian high-tech cooperation", War on the Rocks, August 12, 2020, https://warontherocks.com/2020/08/the-resilience-of-sino-russian-high-tech-cooperation/.

6 Bradley Bowman and Andrew Gabel, "Deeper Partnership With Israel Can Help U.S. Solve Defense Dilemma", Foundation for Defense of Democracies, November 7, 2019, https://www.fdd.org/analysis/2019/11/07/deeper-partnership-with-israel-can-help-us-solve-defense-dilemma/.

For the United States:

- Israel is a principal military ally in West Asia. It is a technologically advanced partner for research and development in emerging technologies in defence and cybersecurity and also other domains such as renewable energy and food security.[7] Israeli defence companies such as Israel Aerospace Industries (IAI) have an extensive engagement with U.S. defence companies like Boeing and Lockheed Martin. Silicon Valley majors such as IBM, Intel and Google have tapped into Tel Aviv's start-up ecosystem for years.
- India has emerged as a principal U.S. partner in the Indo-Pacific and offers a large market for its defence industry. The U.S. has developed a thriving defence and security partnership with India since signing the "Framework Agreement for Defence Cooperation" in 2005 (renewed in 2015).[8] In 2020, the ties were elevated to a "comprehensive global strategic partnership."[9]

For Israel:

- Substantial American foreign and military aid has enabled Jerusalem to achieve a qualitative military edge over its quantitively superior Arab neighbors.[10] Israel has used American aid to innovate and develop military hardware such as the Iron Dome and David's Sling missile and air defence systems, providing its territory and population much-needed protection from rockets and projectiles fired from neighboring territories. As a Major Non-NATO Ally (MNNA) of the U.S., it gets specific military benefits like advanced defence technologies on a priority basis and intelligence-sharing.[11] The high degree of mutual trust between the two countries is also evident with Israel being the only country to receive unfettered access to American military technology and equipment such as the F-35 fighter jet.[12]
- India is the largest purchaser of Israel's weapons, which has provided the latter's defence industry much-needed, stable access to a larger market and funding for its R&D.[13] There is also extensive people-to-people contact between the two countries. Joining hands with India in expanding the scope of bilateral defence cooperation to include the U.S., will not only reinforce its access to the Indian market, but also offer opportunities for exports to emerging markets in Asia and Africa—India's traditional defence export destinations.

7 Robert D. Blackwill and Philip H. Gordon, "Repairing the U.S.-Israel Relationship", Council on Foreign Relations Special Report No. 76, November 2016, https://cdn.cfr.org/sites/default/files/pdf/2016/11/CSR76_BlackwillGordon_Israel.pdf: 4.

8 United States Department of Defense, "Framework for the U.S.-India Defense Relationship", 3 June 2015, <https://dod.defense.gov/Portals/1/Documents/pubs/2015-Defense-Framework.pdf>

9 "Joint Statement: Vision and Principles for India-U.S. Comprehensive Global Strategic Partnership", Ministry of External Affairs, Government of India, accessed January 26, 2021, https://www.mea.gov.in/bilateral-documents.htm?dtl/32421/Joint_Statement_Vision_and_Principles_for_IndiaUS_Comprehensive_Global_Strategic_Partnership.

10 Mark Broude, Saadet Deger and Somnath Sen, "Defence, innovation and development: the case of Israel", Journal of Innovation Economics and Management 2, No. 12 (2013): 37-57.

11 Sameer Patil, "Benefits of becoming a U.S. Major Non-NATO Ally", Gateway House, July 18, 2019, https://www.gatewayhouse.in/non-nato-ally-status/.

12 "Israel's 5th Generation Fighter", Lockheed Martin, accessed January 26, 2021, https://www.f35.com/f35/global-enterprise/israel.html.

13 Data on arms exports generated from SIPRI Trend Indicator Value Tables. See "TIV of arms exports from Israel, 2010-2019", SIPRI, accessed January 26, 2021, https://armstrade.sipri.org/armstrade/html/export_values.php.

For India:

A potential trilateral defence cooperation will build on the robust bilateral defence and security cooperation developed in the last decade with the U.S. and Israel. Both countries are major defence suppliers to India. They have also taken the initial steps in joint R&D with India's state-owned defence R&D base.

- **Israel:** Driven by the shared threat perception of being surrounded by hostile neighbors, India-Israel relations have come a long way since the establishment of diplomatic relations in 1992.[14] Israel's annual arms sales to India averages $1 billion and is the mainstay of the bilateral relationship. The purchase of various radar and missile defence systems along with drones and avionics (see Table 4 in appendix) from Israel have augmented the Indian military's surveillance and operational capabilities.[15] Israel has supplied India satellite imagery, hand-held thermal imagers and night vision devices which have proved particularly valuable in counterterrorism operations.[16]

  Israel has aligned itself with the 'Make in India' initiative which has prioritised the development of a domestic defence industry.[17] Both countries have co-developed and operationalised the Barak-8 air and missile defence system.[18] They have expanded this cooperation by setting up a bilateral sub-working group on defence industrial cooperation, in September 2020, to focus on technology transfer, co-development and co-production, AI, innovation and joint export to friendly foreign countries.[19]

  The three major Israeli defence companies—IAI, Rafael Advanced Defense Systems and Elbit Systems—have multiple, long-term joint ventures with Indian private sector companies including Bharat Forge, Tech Mahindra, Adani Group and Tata Advanced Systems to produce niche sub-systems and homeland security systems (see Table 5 in appendix). For instance, the joint venture between Elbit Systems and Adani Defence and Aerospace operates in Hyderabad, the only facility outside Israel which produces the Hermes 900 unmanned aerial vehicle (UAV).[20] In fact, Israeli companies have been quick to identify and use the unique technological solutions offered by Indian companies. A prominent example is Bengaluru-based Tonbo Imaging, whose specialised electro-optics technology has been part of Rafael and IAI's precision-guided bombs for years. [21]

14 *P. R. Kumaraswamy, India's Israel Policy (New York: Columbia University Press, 2010), 264.*

15 *Alvite Singh Ningthoujam, "India-Israel Defense Cooperation", BESA Center Perspectives Paper No. 236, January 27, 2014, https://besacenter.org/perspectives-papers/india-israel-defense-cooperation/.*

16 *Vinay Kaura, "Indo-Israeli Security Cooperation: Onward and Upward", BESA Center Perspectives Paper No. 522, July 8, 2017, https://besacenter.org/perspectives-papers/india-israel-security-cooperation/.*

17 *Alvite Ningthoujam, "The Future of India-Israel Arms Trade", The Jerusalem Institute for Strategy and Security, July 21, 2020, https://jiss.org.il/en/ningthoujam-the-future-of-india-israel-arms-trade/.*

18 *"Successful Interception Test to IAI's Barak-8 Air & Missile Defense System", Israel Aerospace Industries, accessed 26 January 2021, https://www.iai.co.il/successful-interception-test-iais-barak-8-air-missile-defense-system.*

19 *"Webinar with Israel on Defence Industry Global Outreach for Collaborative Partnership: Webinar and Expo held on 24 Sep 2020", Ministry of Defence, accessed 26 January 2021, https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1658897.*

20 *"Adani Elbit JV Further Steps Up Their Presence In The International Market", Adani Defence and Aerospace, accessed 26 January 2021, https://www.adanidefence.com/newsroom/media-release/Adani-Elbit-JV-further-steps-up-their-presence-in-the-international-markets.*

21 *Malavika Velayanikal, "Bengaluru tech gives US, Israeli weapons eyes", Mint, November 17, 2019, https://www.livemint.com/companies/start-ups/bengaluru-tech-gives-us-israeli-weapons-eyes-11574009242060.html.*

- **United States:** Since formalising defence cooperation, India has been inching up the ladder in the U.S. defence bureaucracy: In 2016, it acquired the unique status of 'Major Defense Partner' which opened access to advanced American defence technology. In 2017, the updated National Security Strategy described India as a "leading power and stronger strategic and defense partner".[22] This was followed by India receiving the Strategic Trade Authorisation-1 status in 2018, enabling it to access dual-use high technology items—a major breakthrough as India had been denied these technologies for a long time.[23]

  Defence trade and technology co-development and co-production are the two most important dimensions of this relationship. Between 2005 to 2020, the bilateral defence trade was $20 billion (see Table 4 in appendix).[24] American defence equipment has added considerable value to the Indian military's power projection and surveillance capabilities, particularly in the Indo-Pacific domain.

  Beyond defence trade, India's persistent efforts to achieve self-reliance in defence have offered opportunities for bilateral engagement in technology co-development and co-production through the Defence Technology and Trade Initiative (DTTI) mechanism, created in 2012.[25] While the initial focus of this cooperation was on basic technologies—identified as 'pathfinder projects',[26] the approach has evolved into a focus on customised technologies, which are mutually beneficial. Current projects include co-development of air-launched drones and lightweight small arms technology (see Table 1).[27] Also as part of the DTTI, the U.S. is working with India on aircraft carrier design. These technologies are still in the exploratory phase and therefore demonstrable progress is slow.

Table 1: India-U.S. defence technology cooperation

Near term projects	Air-launched Small Unmanned Aerial Systems (UAS), Light Weight Small Arms Technology and Intelligence-Surveillance-Targeting & Reconnaissance
Medium-term projects	Maritime Domain Awareness Solution and Virtual Augmented Mixed Reality for Aircraft Maintenance
Long-term projects	Terrain Shaping Obstacle and Counter-UAS, Rocket, Artillery & Mortar System for the Indian Army

Source: Gateway House Research

22 The White House, "National Security Strategy of the United States of America", December 2017, https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf.

23 "U.S.-India Major Defense Partners: Implementation Under the Export Administration Regulations of India's Membership in the Wassenaar Arrangement and Addition of India to Country Group A:5", Bureau of Industry and Security, Commerce, accessed January 26, 2021, https://www.federalregister.gov/documents/2018/08/03/2018-16691/us-india-major-defense-partners-implementation-under-the-export-administration-regulations-of-indias.

24 Department of State, "Fact Sheet: U.S. Security Cooperation With India", January 20, 2021, https://www.state.gov/u-s-security-cooperation-with-india/.

25 "India Defense Technology and Trade Initiative (DTTI)", Office of the Executive Director for International Cooperation, Department of Defense, https://www.acq.osd.mil/ic/dtti.html.

26 Sameer Patil, "Business underpins India-U.S. defence deal", Gateway House January 25, 2020, https://www.gatewayhouse.in/business-underpins-india-u-s-defence-deal/.

27 Mehta, Aaron, "US, India collaborating on air-launched drone", Defense News, 18 March 2019, <https://www.defensenews.com/global/asia-pacific/2019/03/18/us-india-collaborating-on-air-launched-drone/>

Through commercial joint ventures between American and Indian companies, India has built a substantial defence-industrial capability, enabling domestic players, like the Tata Group and Bharat Forge, to manufacture and export subsystems as an active participant of the global supply chain (see Table 5 in appendix).[28]

It is these existing bilateral partnerships that a trilateral cooperation will seek to synergise and expand. A focus on emerging technologies, taking advantage of the deep defence innovation in Israel and the U.S., will offer a clear pathway to initiate and develop this cooperation.

The idea of a trilateral cooperation is not unknown—but it is unfulfilled. In recent years, Indian American diaspora associations along with Jewish American associations in the U.S. have repeatedly raised the idea of a technology triangle between the three countries.[29] Similarly, in September 2020, Bonnie Glick, then Deputy Administrator of the United States Agency for International Development (USAID) revealed that the three countries had explored initial cooperation in 5G mobile communication technology.[30]

Challenges

These strategic convergences notwithstanding, Israel and India's defence relations with other countries pose challenges for this potential trilateral cooperation. Among these are India's Cold War-origin defence ties with Russia. India has veered away from Russia in the last decade with the emergence of Israel and the U.S. as principal weapons suppliers. Yet, in recent years India has purchased some major equipment from Russia including Sukhoi-30 fighter jets, Admiral Grigorovich-class stealth frigates and S-400 missile system; the purchase of the latter has caused considerable irritation in the India-U.S. bilateral relationship. India has explained the rationale of acquiring this system to the U.S. Still, under the Countering America's Adversaries Through Sanctions Act, the latter is obliged to impose sanctions against countries that engage in significant transactions with Russia's security establishment. Washington has repeatedly emphasised that New Delhi is unlikely to get a waiver from these sanctions. This issue is expected to generate friction as the delivery of the S-400 is scheduled to begin by end-2021.

28 Sameer Patil, "Deepening India-U.S. defence partnership", Gateway House, November 5, 2020, https://www.gatewayhouse.in/india-u-s-defence-ties/.

29 PTI, "Indian Americans launch tech triangle for India, Israel & US", The Economic Times, February 19, 2018, https://economictimes.indiatimes.com/nri/nris-in-news/indian-americans-launch-tech-triangle-for-india-israel-us/articleshow/62987036.cms?from=mdr.

30 "Deputy Administrator Glick's remarks at the AJC virtual summit on U.S.-India-Israel relations", USAID, accessed on January 26, 2021, https://www.usaid.gov/news-information/press-releases/sep-3-2020-da-glick-remarks-american-jewish-committee-us-india-israel-summit.

31 Amit Bhandari, Chaitanya Giri and Kunal Kulkarni, "U.S. Sanctions on Russia and its impact on India", Gateway House Research Paper No. 14, September 4, 2018: 10.

32 Rahul Bedi, "Why Is the US Saying India Could Face Sanctions for Buying Russian S-400 Missile Systems?", The Wire, January 20, 2021, https://thewire.in/security/us-india-sanctions-caatsa-s400-russia.

Israel's defence ties with China and Pakistan are another factor influencing this trilateral cooperation. Israeli arms sales to China began in the 1980s and flourished over the years. But by late 1990s, concerned with the qualitative upgrade of Chinese military capabilities, the U.S. began to veto Israeli arms sales including a highly lucrative deal involving the sale of the Phalcon airborne early warning radar system.[33] In 2005, reported sales of Harpy drones to China prompted the U.S. to show its resentment by imposing sanctions on Israel.[34] It also resulted in signing of an agreement called "Declaration of Understanding on Technology Exports", which formally halted Israeli arms sales to China.[35] Since then, no additional official sales to China have been reported. However, the Israeli media has reported some instances of unofficial and illegal sales to China, including a recent example of "armed loitering missiles"/"suicide drones" sale, which is now under Israeli Police investigation.[36] Earlier, Israeli media had also reported similar sales to Pakistan.[37]

These defence ties with other countries may complicate the partnership as they may be perceived as disregarding other partners' security interests. Therefore, for the trilateral collaboration to succeed, the three countries must address their differences and develop a shared understanding of the threat environment, particularly in the Indo-Pacific.

33 Sameer Patil, "Understanding the Phalcon Controversy," Israel Journal of Foreign Affairs 11, No. 2 (2008): 91-98.

34 Conal Urquhart, "US acts over Israeli arms sales to China", The Guardian, June 13, 2005, https://www.theguardian.com/world/2005/jun/13/usa.israel.

35 Jeremy M. Sharp, "U.S. Foreign Aid to Israel", Congressional Research Service RL33222, November 16, 2020, https://fas.org/sgp/crs/mideast/RL33222.pdf: 30.

36 Israel Police (@IL_police), "In recent months, more than 20 Israeli citizens, including those from the defense industry, have been questioned on suspicion of engaging in the development, production, testing and sale of illegally roaming missiles for a country in Asia. The investigation revealed that they received instructions for action from entities related to the same country, in exchange for receiving funds and benefits", Twitter Tweet, February 11, 2021, https://twitter.com/IL_police/status/1359817404503777283.

37 Aluf Benn, "Israel Selling Military Wares to Mideast Countries, Britain Says", Haaretz, June 11, 2013, https://www.haaretz.com/.premium-israel-selling-arms-to-muslim-countries-1.5277220.

3. Capitalising on Defence Innovation and a Start-Up Ecosystem

Collaborating and building on defence innovation capabilities is key to achieving a long-term advantage in defence research and development. Therefore, to develop an India-Israel-U.S. defence technology partnership, the necessary starting point must be the existing defence innovation bases or start-up ecosystems in Israel and the U.S. These have provided the required technological capabilities to their respective militaries for years. India too has begun to harness the potential of the start-up ecosystem as part of its broader efforts to achieve self-reliance in defence.

In the U.S., compared with the initial technological innovation which originated in government-funded research facilities, today the locus has decisively shifted to the start-up ecosystem in Silicon Valley. This shift happened due to:

1. A decline in the defence R&D budget (from more than 1.2 percent of Gross Domestic Product (GDP) in 1976, to 0.8 percent of GDP in 2019).[38]
2. Investment by the flourishing tech majors like Google and Amazon, in innovative technologies such as robotics and quantum computing.[39]
3. The enormous amount of venture capital investment in tech start-ups.[40]

The 2017 National Security Strategy acknowledged that the private sector had taken a lead over federal government agencies and underlined the need for the federal government to tap into these private capabilities.[41] The Pentagon still spends a substantial amount of money on R&D as compared to many other industrialised economies—$59 billion as per the 2021 budget request.[42] However, its pace of R&D and innovation is simply insufficient to maintain a lead over China, which not only stole technologies from the West but also consistently expanded investment in R&D over the last two decades and drafted its private sector into this effort. These investments have intensified under the "Made in China 2025" industrial strategy.[44]

One prime example of Silicon Valley's lead in emerging technologies is quantum computing

38 Matt Hourihan, "Review of Research & Development in the Final FY 2021 Omnibus", American Association for the Advancement of Science, January 2021, https://www.aaas.org/news/rd-fy-2021-omnibus-review-and-estimates.

39 John F. Sargent Jr., Marcy E. Gallo and Moshe Schwartz, "The Global Research and Development Landscape and Implications for the Department of Defense", Congressional Research Service R45403, November 8, 2018, https://fas.org/sgp/crs/natsec/R45403.pdf: 14.

40 Michel Ferrary and Mark Granovetter, "The role of venture capital firms in Silicon Valley's complex innovation network", Economy and Society 38, No. 2 (May 2009): 326-359.

41 The White House, "National Security Strategy of the United States of America", December 2017, https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf.

42 John F. Sargent Jr., Marcy E. Gallo and Moshe Schwartz, "The Global Research and Development Landscape and Implications for the Department of Defense", Congressional Research Service R45403, November 8, 2018, https://fas.org/sgp/crs/natsec/R45403.pdf: 4.

43 Patrick Tucker, "US Defense R&D Funding Falls As China's Keeps Growing", Defense One, February 10, 2020, https://www.defenseone.com/technology/2020/02/us-defense-rd-funding-falls-chinas-keeps-growing/163021/.

44 Govini, "America's eroding technological advantage: NDS RDT&E priorities in an era of great-power competition with China", https://www.govini.com/americas-eroding-technological-advantage-nds-rdte-priorities-in-an-era-of-great-power-competition-with-china/.

45 Sagnik Chakraborty, "India's billion-dollar quantum push", Gateway House, February 13, 2020, https://www.gatewayhouse.in/indias-push-quantum/.

technology which can be applied to a variety of defence applications such as navigation, radar systems and sensing.[45] Even as the U.S. plays catch-up up with China in quantum research, American tech giants IBM and Google have already achieved breakthroughs. In 2019, IBM unveiled Q System One, the first commercial quantum computer.[46] This was followed by Google, which claimed quantum supremacy while unveiling Sycamore, its own quantum computer.[47]

The Pentagon has tried to tap into Silicon Valley innovations by setting up the Defense Innovation Unit (DIU, earlier known as DIUx). Headquartered in Mountain View, California, in the heart of the Valley, DIU works closely with the tech industry and start-ups to shortlist, fund and develop emerging technologies including AI, autonomous systems, cyber, space, human systems, and advanced energy and materials.[48] A key obstacle for engaging start-ups in the defence sector is that start-ups view the defence establishment as bureaucratic and its acquisition procedures as cumbersome.

But by co-locating itself in the Silicon Valley and hiring staff from the tech and start-up community, the Pentagon has attempted to align itself with the vibrant start-up ecosystem and cut through traditional bureaucratic red tape to develop new technology and integrate it into the military.[49]

DIU has faced resistance from the risk-averse defence bureaucracy, but it promises to bring a change. For instance, working with partners from the Valley, the DIU developed and demonstrated a submarine-launched unmanned aerial system within a record time of eight months from the project's commencement in May 2019.[50] By September 2020, this system had already been deployed in the submarine fleet, something which typically takes years in the Department of Defense's standard—often described as 'antiquated'—acquisition procedure.[51]

Compared to the U.S., Israel takes a more organic approach to defence innovation, by synchronising the military, academia, defence industry, start-ups and investors. This has created a thriving defence innovation base centered around Tel Aviv and positioned Israel as a technologically advanced military power.

45 Sagnik Chakraborty, "India's billion-dollar quantum push", Gateway House, February 13, 2020, https://www.gatewayhouse.in/indias-push-quantum/.

46 "IBM Unveils World's First Integrated Quantum Computing System for Commercial Use", IBM, accessed February 5, 2021, https://newsroom.ibm.com/2019-01-08-IBM-Unveils-Worlds-First-Integrated-Quantum-Computing-System-for-Commercial-Use.

47 "Quantum Supremacy Using a Programmable Superconducting Processor", Google AI Blog, accessed February 5, 2021, https://ai.googleblog.com/2019/10/quantum-supremacy-using-programmable.html.

48 "Why DIU," Defense Innovation Unit, accessed 26 January 2021, https://www.diu.mil/solutions.

49 Ibid.

50 Richard R. Burgess, "Admiral: Submarine-Launched UAS Proving 'Awesome Capability'", SeaPower, November 18, 2020, https://seapowermagazine.org/admiral-submarine-launched-uas-proving-awesome-capability/.

51 Lara Seligman, "Why the military must learn to love Silicon Valley", Foreign Affairs, September 12, 2018, https://foreignpolicy.com/2018/09/12/why-the-military-must-learn-to-love-silicon-valley-pentagon-google-amazon/.

There are multiple factors undergirding Israel's approach to defence innovation.

- Foremost is the Jewish perception of 'siege mentality' — a belief that the world is predisposed to behave negatively towards them. Since its creation, Israel has been surrounded by hostile neighbors, which has led to the ingrained belief, in Israel's national and military leadership, that the only way to overcome this hostile strategic environment is by attaining a qualitative military edge over its adversaries.[53]
- Another factor is a "double feeding" phenomenon — whereby knowledge about the military's technological requirements constantly circulates through the ecosystem due to conscription or compulsory military service. So, people who have served in the military become part of the tech industry, academia and start-up ecosystem, and are well aware of their military's requirements.[54]
- Conscription also means that most of Israelis get an exposure to technology, either through the intelligence apparatus, coding or cyber security.[55] This creates a valuable tech-savvy resource pool for the country's technological-industrial ecosystem.
- Funding is also important: Israel has consistently topped the global charts for spending upwards of 4% of its GDP on R&D.[56]

These factors make Tel Aviv the second-best innovation base, after Silicon Valley, earning Israel the tag of "Start-up Nation".[57]

Due to Israel's geography, this ecosystem is close-knit with most of the critical actors being co-located. This ingrained advantage has been utilised by the Israeli Ministry of Defense's Directorate of Defense Research & Development (also known as Maf'at), Israel Defense Forces (IDF) and the industry and start-ups to apply emerging technologies for defence use. For instance, the Iron Dome system developed with U.S. assistance uses AI to analyse incoming missiles and determine if people are in danger.[58] Likewise, the IDF has used AI to understand videos and read out the events taking place on the screen.[59]

The IAI too has sought to promote start-ups through an accelerator track, which encourages select start-ups to develop new technologies based on AI.[60]

52 A history of religious persecutions and campaign of hatred, symbolised by the Holocaust, has established this siege mentality in the Jewish tradition. See Daniel Bar-Tal and Dikla Antebi, "Siege mentality in Israel", International Journal of Intercultural Relations 16, no. 3 (1992): 251–275.

53 Dima Adamsky, The Culture of Military Innovation, (Stanford: Stanford University Press, 2010), 97.

54 INSS Israel, "David vs. Goliath: Regaining the Israeli Lead in Artificial Intelligence / Dr. Liran Antebi", YouTube video, January 26, 2021, https://www.youtube.com/watch?v=GSQRZ2vF3vQ&feature=emb_title.

55 Gili S. Drori, "STEM in Israel: The Educational Foundation of 'Start-Up Nation'", Australian Council of Learned Academies, January 2013, https://acola.org/wp-content/uploads/2018/12/Consultant-Report-Israel.pdf.

56 "Gross domestic spending on R&D", OECD, accessed February 5, 2021, https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm.

57 Dan Senor and Saul Singer, Start-up Nation: The Story of Israel's Economic Miracle, (New York: Hachette, 2009).

58 Jim Garamone, "Esper Sees Iron Dome Missile Defense System in Tel Aviv"

59 "The IDF's New Artificial Intelligence Can Tell You What's Happening in a Video", IDF, December 15, 2016, https://www.idf.il/en/minisites/technology-and-innovation/the-idf-s-new-artificial-intelligence-can-tell-you-what-s-happening-in-a-video/.

60 Eytan Halon, "Israel Aerospace Industries targets tech acceleration with new innovation center", The Jerusalem Post, December 25, 2019, https://www.jpost.com/jpost-tech/israel-aerospace-industries-targets-tech-acceleration-with-new-innovation-center-612082.

India has begun to look at start-ups as a way to equip its military with niche technology capabilities. Drawing from the U.S.' DIU experience, India launched a Defence Innovation Organisation and Innovations in Defence Excellence (iDEX) program in 2017 to work with the R&D institutes, academia, industry, start-ups and individual innovators to create solutions to overcome the military's technological shortcomings.[61] Early technologies identified by iDEX for R&D include soldier protection systems, secure hardware encryption devices, GPS anti-jam devices, unmanned surface and underwater vehicles, and 4G/LTE tactical local area network, among others.[62] According to the government, more than 300 start-ups are currently engaged by the iDEX program.[63] To learn more from DIU experience on engaging start-ups, India and the U.S. have also agreed to assign Indian liaison officers to the DIU's unit in Silicon Valley.[64]

There is an opportunity to take this one step forward by joining hands with Israel and the U.S. on emerging technologies. This potential collaboration must conjoin the three innovation hubs of Silicon Valley, Tel Aviv and Bengaluru to capitalise on their respective strengths and declared national technology priorities. As Table 2 shows, Bengaluru and Hyderabad, separated by roughly 550 kms., have a vibrant defence industrial base[65] with multiple defence public sector units, the Defence Research and Development Organisation (DRDO) research establishments, private sector companies (including joint ventures with American and Israeli companies) and several start-ups in the defence and aerospace sector which are already contributing in various capacities to India's defence and space needs.

61 Sameer Patil, "A Defence Industrial Agenda for India", Gateway House, Paper No. 24, July 2020, https://www.gatewayhouse.in/wp-content/uploads/2020/08/Defense-Industrial-Agenda_Sameer-Patil_2020_Final.pdf.

62 "Innovations for Defence Excellence (iDEX)", Department of Defence Production, Ministry of Defence, accessed February 5, 2021, https://makeinindiadefence.gov.in/pages/innovations-for-defence-excellence-idex.

63 "iDEX – Start-up Manthan to promote innovation in defence organised at Aero India 2021", Press Information Bureau, Government of India, accessed on February 5, 2021, https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=1695487.

64 Manu Pubby, "India finalising proposal to send defence teams to Silicon Valley", The Economic Times, August 30, 2018, https://economictimes.indiatimes.com/news/defence/india-finalising-proposal-to-send-defence-teams-to-silicon-valley/articleshow/65601247.cms.

65 R. Viswanathan, "Brazilian Embraer can inspire HAL", Gateway House, February 20, 2015, https://www.gatewayhouse.in/brazilian-embraer-can-inspire-hal/.

Table 2: Defence-industrial base in Bengaluru and Hyderabad

Defence Public Sector Units	DRDO Establishments	Private Sector	Start-ups
BENGALURU			
• Hindustan Aeronautics Limited, • BEML Complex, • Bharat Electronics	• Aeronautical Development Establishment • Centre for Artificial Intelligence & Robotics, • Defence Avionics Research Establishment	• Taneja Aerospace and Aviation • Tata Power Strategic Engineering Division	• Tonbo Imaging • Aadyah Aerospace • Axio Biosolutions • Bellatrix Aerospace* • Aurora Integrated Systems • HyperVerge (Geospatial) • Optimized Electrotech • CM Envirosystems • Indian Institute of Science, Bangalore#
HYDERABAD			
• Bharat Dynamics Limited • Mishra Dhatu Nigam Limited • Bharat Electronics-Hyderabad unit • BrahMos Integration Complex • HAL Avionics Division	• Defence Electronics Research Laboratory • International Advanced Research Centre for Powder Metallurgy and New Materials@	• Tata Advanced Systems • Adani Aerospace Park • Adani Elbit UAV complex • Premier Explosives • Kalyani Rafael Advanced Systems	• Skyroot Aerospace* • T-Hub accelerator# • Indian Institute of Technology, Hyderabad#

** Civilian aerospace start-up # Incubator @ Under the Department of Science and Technology*

Source: Gateway House Research

Technology	Details
Quantum Science	• This technology is still in nascent stages but has wider implications for encrypted communications, cryptography, aerospace engineering, radar, modelling and simulation, navigation etc.[66] • Israel's defence ministry has allocated approximately $91 million (NIS300 million) for research on quantum technology including sensors and encryption.[67] It also has an industrial and academic consortium for studying quantum-based military and civilian applications.[68] • The U.S.' National Quantum Initiative Act has allocated $1.2 billion for research in quantum technology. • India too has announced the National Mission on Quantum Technologies & Applications.[69]
Artificial Intelligence	• Current applications include image and text analysis for data analysis purposes, logistics, assistance in decision-making, autonomous vehicles and aerial systems, cyber security etc.[70] Additionally, AI can also be used for security, surveillance and inventory management.[71] • An example of application of this technology is the controversial Project Maven between Google and the U.S. Department of Defense, intended to enhance targeting and surveillance capabilities of drones on the battlefield.[72] • In India, a task force on AI by the Ministry of Defence has proposed setting up of the Defence AI Project Agency. The report also noted the use of AI for combat systems and recommended joining hands with start-ups for development of the technology.[73] • India and U.S. are also part of The Global Partnership on Artificial Intelligence, which focuses on devising rules for governing the use of AI.

66 Victor Pratap Singh, Quantum Computing - A Strategic Enabler: Practicability, Applications and Way Ahead, MPhil Dissertation, Naval War College, Goa-University of Mumbai, 2019.

67 Uri Berkovitz, "Israel joins the quantum club", Globes, December 2, 2019, https://en.globes.co.il/en/article-israel-joins-the-quantum-club-1001309384.

68 Yuval Azulai and Uri Berkovitz, "Israel readies for quantum leap", Globes, September 9, 2019, https://en.globes.co.il/en/article-israel-readies-for-quantum-leap-1001300078.

69 Sagnik Chakraborty, "India's billion-dollar quantum push", Gateway House, February 13, 2020, https://www.gatewayhouse.in/indias-push-quantum/.

70 Liran Antebi and Gil Baram, "Cyber and Artificial Intelligence—Technological Trends and National Challenges", Cyber, Intelligence, and Security 4. No. 1 (March 2020): 134-136.

71 Amrut Godbole, "AI & Machine Learning for the Indian Navy", Gateway House, Paper No. 21, April 2020, https://www.gatewayhouse.in/wp-content/uploads/2020/04/AI-Machine-Learning-paper-for-the-Indian-Navy_Cdr-Godbole_Final-Version_GH-1.pdf.

72 Lee Fang, "Google hedges on promise to end controversial involvement in military drone contract", The Intercept, March 2, 2019, https://theintercept.com/2019/03/01/google-project-maven-contract/.

73 "AI task force hands over Final Report to RM", Press Information Bureau, Government of India, June 30, 2018, https://pib.gov.in/newsite/PrintRelease.aspx?relid=180322.

Technology	Details
UAVs and Drones	• Drone technology is already becoming cheaper and today offers far more sophisticated capabilities. Harnessing U.S. and Israeli expertise in drones, focus can be on enhancing border surveillance, counter-terrorism operations and penetrating and neutralising enemy air defence systems through swarm drones. • India and U.S. have previously explored R&D on the hand-launched Raven drone system as part of defence technology cooperation. • Under the iDEX program, India is testing underwater drone prototypes from Eyerov Technologies.[74]
Blockchain	• This technology has its potential uses in cyber security, secured communications, logistics support and supply chain management etc. Israel's expertise in cyber and cryptography gives it a unique advantage in development of blockchain technology.
Autonomy and Robotics	• In addition to surveillance, robotic systems can perform many tasks, considered risky for humans like countermining and bomb defusal. They can perform complex navigation and react in real-time in a threat environment. • IAI's current robotic systems can perform counter-IED operations and supply deliveries, fully autonomously or with human intervention.[75] It is currently researching swarm robotics. • In India, the Centre for Artificial Intelligence and Robotics of the Defence Research and Development Organisation is currently researching industrial and mobile robots.[76]
5G/6G	• India, Israel and the U.S. have already explored 5G technology as an area of initial cooperation. This can be taken forward to look at software-based rather than hardware-based systems such as the Open Radio Access Network or O-RAN.[77] The three countries can also explore next generation 6G mobile communication standard, which is still at the theoretical stage.[78]

74 "Eyerov Technologies" iDEX, accessed on February 5, 2021, https://idex.gov.in/showcase-cpt/235.

75 Arie Egozi, "US Army Pursues Israeli Robots", Breaking Defense, November 12, 2018, https://breakingdefense.com/2018/11/us-army-pursues-israeli-robots/.

76 "Technologies", Centre for Artificial Intelligence & Robotics, accessed on January 26, 2021, https://www.drdo.gov.in/labs-establishment/technologies/centre-artificial-intelligence-robotics-cair.

77 Robert A. Manning, "Emerging Technologies: New Challenges to Global Stability", Scowcroft Center for Strategy and Security, Atlantic Council, Issue Brief May 2020, https://www.atlanticcouncil.org/wp-content/uploads/2020/06/Emerging-Technologies-New-Challenges-To-Global-Stability-May-2020.pdf.

78 Chaitanya Giri, "6G, the new frontier", Gateway House, November 14, 2019, https://www.gatewayhouse.in/6g-the-new-frontier/.

79 "How Israel Is Leading Big Breakthroughs in 3D Printing", Israel Trade Missions In India, accessed on January 26, 2021, https://itrade.gov.il/india/2018/11/20/how-israel-is-leading-big-breakthroughs-in-3d-printing/.

80 Adam Stone, "For the Army, a 3-D printed drone is nice. A customized, 3-D printed drone is better." C4ISRNET, February 23,2018, https://www.c4isrnet.com/smr/unmanned-unleashed/2018/02/23/for-the-army-a-3d-printed-drone-is-nice-a-customized-3d-printed-drone-is-better/.

Technology	Details
Additive Manufacturing	• It is already being used in manufacturing of aerospace and naval systems components. The technology may be particularly useful to fulfill operational requirements in a combat environment such as printing spare parts or components of a damaged equipment. • Israel already is one of the biggest users of 3D printing and manufactures about 40% of 3D printers worldwide.[79] • The U.S. Army Research Laboratory has successfully demonstrated 3D printing of a drone in experimental environments.[80] The possibilities for application are endless as evident from another experiment where researchers from Princeton University 3D printed a bionic ear which can receive and transmit sound, pick up radio signals and also hear signals a million times higher than a human ear.[81]
Advanced Battery Technology and Power Sources	• Autonomous systems including robots and drones critically depend on battery power. • The U.S. Department of Defense has invested in R&D for a more durable lithium-ion battery as well as to develop new battery materials including lithium-sulfur, which would offer better and more stable performance. India and the U.S. had previously explored a mobile electric hybrid power sources project as part of bilateral defence technology cooperation, to consider ways to provide power for soldiers deployed in remote locations. • IDF too has explored alternative battery power sources.

Source: Gateway House Research

As evident, Israel and the U.S. have already reached an advanced stage of research and cooperation for many of these technologies — compared to India which is still discussing the implications of some technologies like AI and quantum computing, and expanding its technological capabilities in others ¬— such as robotics.[82]

These are disruptive technologies and will shape military doctrines and direct the nature of future warfare. A glimpse of this disruption was available during the fighting between Armenia and Azerbaijan in September-November 2020 over the disputed Nagorno-Karabakh territory. During the fighting, Azerbaijan deployed armed drones (purchased from Israel and Turkey) and smart weapons to inflict significant damage on Armenia, which relied on its air defences and tanks.[83]

81 "3D printing and defence: an industry revolution in the making?", Defence Contracts Online, accessed May 11, 2020, https://web.archive.org/web/20200426201530/https://www.contracts.mod.uk/blog/3d-printing-and-defence-an-industry-revolution-in-the-making/.

82 "Indian Army organises seminar on impact of disruptive technologies on fighting philosophy in future conflicts", Press Information Bureau, Government of India, August 25, 2020, https://www.pib.gov.in/PressReleasePage.aspx?PRID=1648573.

83 Robyn Dixon, "Azerbaijan's drones owned the battlefield in Nagorno-Karabakh — and showed future of warfare", The Washington Post, November 12, 2020, https://www.washingtonpost.com/world/europe/nagorno-karabkah-drones-azerbaijan-aremenia/2020/11/11/441bcbd2-193d-11eb-8bda-814ca56e138b_story.html.

This example, along with similar experiences from the battlefields in Syria and Libya, demonstrates that "software-first" technologies like AI-enabled drones and robotics will play a decisive role in determining the outcomes of the wars of the future.[84]

This collaboration also offers opportunities for the Indian IT companies which have done coding for the Indian military, to play a major role. Companies such as Tata Consultancy Services, Wipro and HCL Technologies can help the Indian military better identify global technological trends and participate in defence innovation.

These technologies provide a good foundation for trilateral defence cooperation, which will give a technological edge to their respective militaries. Acquisition of these capabilities will particularly augment options for the Indian and American militaries in dealing with an aggressive China, which has adopted a hybrid warfare strategy against its adversaries.

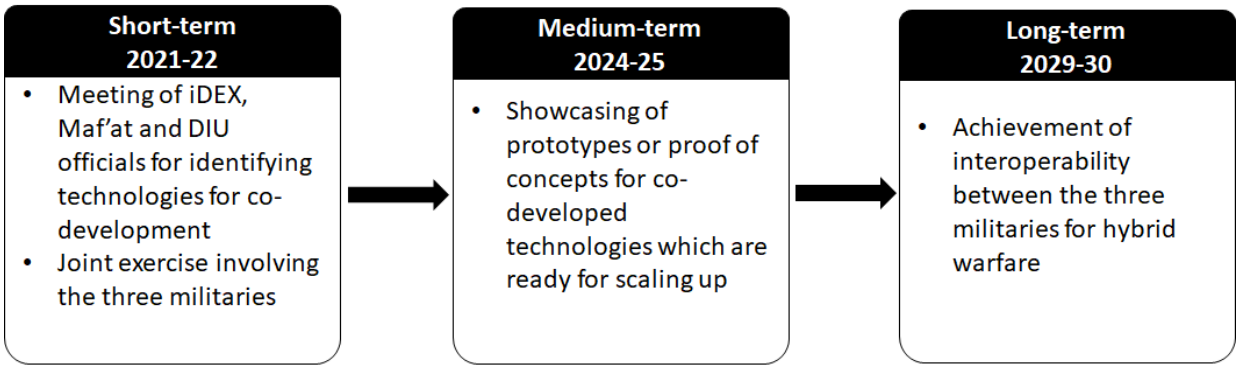
In many cases, the military can serve as a potential incubator for these technologies. The dual-use characteristic of these technologies means they will have additional potentially beneficial uses, beyond the military ones.

One key policy change that will greatly enable this collaboration is the reduction in the lengthy defence acquisition procedures of India and the U.S. In India, typically such acquisitions take upwards of seven to eight years in the case of major weapons systems. But, ideally, acquisitions should not take more than three to four years. This would be necessary if the start-ups are to play a larger role not just in this trilateral initiative but also in the defence sector, since longer timelines don't fit with start-ups' business models. Successive Indian governments have tried with limited success to reduce the duration of acquisition procedures. However, risk-averse bureaucracies are unwilling to significantly shorten this process.

84 Ali Bakeer, "The fight for Syria's skies: Turkey challenges Russia with new drone doctrine", Middle East Institute, March 26, 2020, https://www.mei.edu/publications/fight-syrias-skies-turkey-challenges-russia-new-drone-doctrine.

4. Shaping the Trilateral Partnership

The materialisation of this partnership should proceed on the following timeline spread over a decade.



To achieve these goals, the three partners must work on the recommendations below:

General

1. Initiate formal collaboration between iDEX, Maf'at and DIU

Building on the existing formal bilateral interactions between the defence bureaucracies, the three countries can initiate discussions for a formal collaboration between India's iDEX, Israel's Directorate of Defence Research & Development (Maf'at) and the U.S.' DIU. Much like bilateral collaborations, this trilateral collaboration can focus on identifying emerging technologies, useful for their respective militaries and appropriate for start-up collaboration. They can then initiate flagship R&D programs around these technologies to develop use case scenarios. Alternatively, a joint group can be established to identify emerging technologies and monitor developments around them in the short term, before deciding to collaborate on them.

2. Define interoperability for the three militaries

A key dimension shaping this trilateral partnership will be developing interoperability among the three militaries. For this, the three partners should define their conceptions of interoperability and elaborate which elements of the force structure should be interoperable. A useful definition of interoperability from the U.S. Department of Defence is "The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces, and to use services so exchanged to enable them to operate effectively together."[86] The three militaries should also institute an annual joint exercise to develop and understand the challenges in achieving interoperability.[87] Such an exercise should be geared towards countering hybrid warfare.

86 Hura, Myron, Gary McLeod, Eric V. Larson, James Schneider, Daniel Gonzales, Daniel M. Norton, Jody Jacobs, Kevin M. O'Connell, William Little, Richard Mesic, and Lewis Jamison, "Interoperability: A Continuing Challenge in Coalition Air Operations. Santa Monica", RAND Corporation, 2000, https://www.rand.org/pubs/monograph_reports/MR1235.html, p. 7.

87 Møller, J. E. (2019). Trilateral defence cooperation in the North: an assessment of interoperability between Norway, Sweden and Finland. Defence Studies, p. 6

3. Develop a Silicon Valley-Tel Aviv-Bengaluru start-up corridor

A critical aspect of this trilateral collaboration will be a start-up corridor involving Silicon Valley, Tel Aviv and Bengaluru, which can bring together the innovation communities located in these geographies to contribute to this partnership. To enable these partnerships, a seed fund can be created by the three countries to offer initial funding to the start-ups' ideas, even before they reach technology demonstration/prototype stage. The seed fund may take the form of a multi-year commitment from the three countries. As in the case of Israel, the military establishments can encourage the start-ups by incubating their ideas and technologies and also provide an avenue for commercialisation by being their first customers. A positive step has already been taken to lubricate the possibility: Air India has begun direct Bengaluru-San Francisco flights;[88] a partnership will create the demand for Bengaluru-Tel Aviv flights as well. Academic collaborations between institutions from the three countries can be explored. Potential partners can be the Indian Institute of Technology Hyderabad (India), Weizmann Institute of Science (Israel) and the Massachusetts Institute of Technology (United States).[89]

4. Establish an annual hackathon and a start-up accelerator

One way to forge collaboration between the start-ups of the three countries is to hold hackathons where the militaries of the three countries conceptualise problem statements with a focus on emerging technologies. To participate, teams will need representation (either a start-up, an individual innovator or academia) from all the three countries. Selected winners may then be given an opportunity to be part of a start-up accelerator, set up by the three countries. The Indian and U.S. armies held an event in 2008 in Agra, called MAV08 encouraging innovators from the two countries to develop viable Micro Air Vehicles technology.[90]

5. Invite Israel to the G20 Summit in India in 2023

India will be host to the G20 nations in 2023. The G20 does not deal with defence cooperation issues, but it is the world's most influential economic multilateral forum. More importantly, its members include 11 of the world's top 20 arms exporters.[91] The host country can invite non-G20 members, countries and organisations, through the regional consultation mechanism process. India can leverage this to make a symbolic gesture and invite Israel to attend the G20 Summit. With its unique experience in start-ups and innovation, Israel will fit the bill at the G20 meetings.

88 Express Web Desk, "Air India first direct flight between Bengaluru and San Francisco from Jan 11", The Indian Express, December 31, 2020, https://indianexpress.com/article/cities/bangalore/air-india-first-direct-flight-between-bengaluru-and-san-francisco-from-jan-11-7127221/.

89 The Massachusetts Institute of Technology is considered here due to its substantial involvement in defense research, though it is geographically not located closer to the Silicon Valley in the U.S.

90 Ed Stiles, "UA Team Ties for Micro Air Vehicle Win at Competition", The University of Arizona News, April 29, 2008, https://news.arizona.edu/story/ua-team-ties-for-micro-air-vehicle-win-at-competition.

91 Data on arms exports generated from SIPRI Trend Indicator Value Tables. See "TIV of arms exports from all, 2018-2019", SIPRI, accessed January 26, 2021, https://armstrade.sipri.org/armstrade/page/values.php.

U.S. specific

6. Designate India as a Major Non-NATO Ally

Influential American lawmakers in the U.S. have made repeated efforts to draw India into the U.S. ambit by designating it as an MNNA, most recently in 2019. These efforts are yet to bear fruit. India has already been uniquely designated as Major Defense Partner. Yet, within the defence and other bureaucracies, there is much less clarity on how this designation is to be used to treat India on a priority basis—precisely because such a status had no precedent. Therefore, the U.S. government must designate India as an MNNA. It will be a symbolically important push within America's bureaucratic decision-making to prioritise India, and also bring it on par with Israel. Moreover, India can accrue specific benefits after MNNA designation including access to advanced defence and commercial space technologies from the U.S. on a priority basis.

Israel-specific

7. Replicate India's collaboration with DIU

India and the United States have agreed to place an Indian liaison officer at the DIU in Silicon Valley. Israel should propose replicating the same by having an Indian officer at Maf'at to understand Israel's Defence Ministry's coordination with other stakeholders of the innovation eco-system: IDF, the industry and the start-ups.

India-specific

8. Identify Bengaluru-Hyderabad as an ecosystem to align with Silicon Valley and Tel Aviv

Taking advantage of the defence-industrial facilities and start-ups in Bengaluru and Hyderabad, India should explore creating the Bengaluru-Hyderabad defence start-ups corridor, along the lines of the defence industrial production corridors in Uttar Pradesh and Tamil Nadu. Like the T-Hub incubator in Hyderabad, separate start-up hubs for the defence sector can be established as part of this, which will bring together serving and retired military officials, mentors and officials in-charge of 'Startup India' to guide individual innovators and start-ups. One important dimension of this will be to create an academic institution—Indian National Defence Technology University either in Bengaluru or Hyderabad, preferably with private sector funding. The academic institution will not only conduct fundamental research on emerging technologies but also have a testbed facility to evaluate technologies. In addition, the university can offer solutions to customise technology to the military's requirements.

5. Conclusion

Rapid technological advancements today will ensure that those nations which harness and adapt them will be ahead of their competitors. It is imperative that India, the U.S. and Israel join hands to expand their advantage. Each country with its unique advantage in the field of science and technology, innovation and start-ups can make a significant contribution to this collaboration. This trilateral partnership holds the promise to advance regional stability and international security.

6. Appendix

Table 4: India's major defence purchases from the U.S. and Israel

	AIRCRAFTS & HELICOPTERS	UAVS	AIR DEFENCE SYSTEMS	MISSILES	SENSORS AND RADARS
India's defence purchases from the U.S.	MH-60 Seahawk maritime helicopters AH-64E Apache attack helicopters Chinook CH-47 heavy-lift transport helicopters C-17 transport aircraft C-130J transport aircraft P-8I Neptune maritime patrol aircraft	MQ-1 Predator (on lease)		AGM-114L-3 Hellfire Longbow missiles AGM-114R-3 Hellfire II missiles Harpoon anti-ship missiles Stinger man-portable air defence missiles	AN/APG-78 fire control radars AN/APR-48B modernised radar frequency interferometers MTADS-PNVS GPS inertial navigation systems
India's defence purchases from Israel		Heron drones Searcher drones Harop drones	Spyder Barak LR	Derby AAM Harop Python-5 SPICE-2000 Griffin Spike ATGM Raptor/Crystal Maze ASM	Phalcon EL/M 2032 EL/M-2083 aerostat radars EL/M-2080 Green Pine radars

Source: Gateway House Research

Table 5: Major partnerships between Indian, American, and Israeli defence companies

U.S.	Lockheed Martin	Tata Advanced Systems	Joint venture called Tata Lockheed Martin Aerostructures Limited supplies components for C-130J aircraft
	Boeing	Dynamatic Technologies	Components for Chinook Helicopters & P-8I aircraft
	Sikorsky Aircraft Company	Tata Advanced Systems	Aerospace components
Israel	Israel Aerospace Industries, Rafael Advanced Defence Systems	DRDO, Bharat Electronics Limited	Development of Barak 8 surface-to-air missile
	ELTA Systems (division of Israel Aerospace Industries)	Tata Advanced Systems	Joint venture called Hela Systems manufactures communications, electronic warfare, and homeland security systems
	Israel Aerospace Industries	Dynamatic Technologies	Manufacturing of UAVs
	Elbit Systems	Bharat Forge	Joint venture called BF Elbit Advanced Systems supplies artillery guns and mortars
	Israel Aerospace Industries	Wipro Aerospace	Aero-structures and other parts
	Elbit Systems	Adani Defence & Aerospace	UAVs
	Elta Systems	Tech Mahindra	Cyber security technologies
	Rafael Advanced Defence Systems	Kalyani Strategic Systems Ltd.	Joint venture called Kalyani Rafael Advanced Systems manufactures missile sub-systems
	Israel Weapon Industries	Punj Lloyd	Small armsSystems manufactures missile sub-systems

Source: Gateway House Research