

MAPPING THE SPREAD OF NEWSPACE COMPANIES DEVELOPING, TESTING, PRODUCING OR MARKETING MISSILE-RELATED TECHNOLOGY: A PILOT STUDY

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INTRODUCTION

The growth of the NewSpace sector is a widespread, although not global, phenomenon and its opportunities and risks are not equally distributed. Only a small share of the many companies in the sector are developing, testing, producing or marketing missile-related technology. The majority of NewSpace companies instead focus on downstream applications, in particular space-based services. Nonetheless, NewSpace is changing the nature of the space industry, exacerbating missile proliferation risks and challenging the effective implementation of export controls.

The Missile Technology Control Regime (MTCR) brings together 35 major supplier states (called the MTCR partners) that have agreed common guidelines for exports of missiles and missile-related technology. They also maintain a control list (the MTCR equipment, software and technology annex) that outlines the set of missile-related technologies the export of which should be subject to licensing requirements. However, the growth of the NewSpace industry has contributed to the increasing number of developers—and potential exporters—of missile-related technology outside established supplier states.

A SIPRI pilot study mapped the NewSpace industry of 84 selected states, including the 35 MTCR partners, 4 states that have submitted a political declaration of adherence to the MTCR guidelines (MTCR adherents) and 45 states not participating in the MTCR (see box 1).¹ More than half of the 49 adherents and other non-partners mapped have companies developing, testing, producing or marketing missile-related technology established in their domestic NewSpace industry. However, just over one-third of the 49 states have adopted the current or a previous version of the MTCR annex as part of their national export control system.

Space launch vehicles (SLVs) of all sizes—particularly small and micro launchers—use many of the same, or at least similar, technologies and major

KEY FACTS

- NewSpace is changing the nature of the space industry, exacerbating missile proliferation risks and posing challenges for the effective implementation of export controls.
- The growth of the NewSpace sector over the past 20 years has resulted in the creation of many NewSpace companies developing, testing, producing or marketing missile-related technology, both in partners of the Missile Technology Control Regime (MTCR) and non-partners.
- At least 11 non-partners have NewSpace companies developing, testing, producing or marketing missile-related technology but have not adhered to the MTCR guidelines or adopted the MTCR annex.
- Of all MTCR non-partners, China has the largest number of NewSpace companies developing, testing, producing or marketing missile-related technology.
- At least 98 NewSpace companies are developing small and micro launchers across 28 states, 8 of which are not MTCR partners.
- The spread of NewSpace companies developing, testing, producing and marketing missile-related technology—in particular small- and micro-launcher companies—is an increasingly important factor for the MTCR and other missile non-proliferation instruments when considering expanding membership and targeting outreach.

¹ For full details of the pilot study see Brockmann, K. and Héau, L., *The Expansion of the NewSpace Industry and Missile Technology Proliferation Risks* (SIPRI: Stockholm, Oct. 2024).

Box 1. About the SIPRI pilot study on the NewSpace industry

Pilot study methodology

This fact sheet is based on data collected for a SIPRI pilot study that mapped the spread of NewSpace industry actors developing, testing, producing or marketing missile-related dual-use technology across Missile Technology Control Regime (MTCR) partners, adherents and non-partners. The data set includes over 600 such companies from 84 selected states, which include 35 MTCR partners, 4 adherents and 45 other non-partners (see figure a).⁴

The study distinguished between two tiers of states and applied a different data-collection focus to each tier. Tier 1 covers the 35 MTCR partners. For these states, the study sought to map the extent to which there are any companies within their domestic NewSpace industries that are developing, testing, producing or marketing missile-related technology across the 17 MTCR annex items. Tier 2 covers the 4 MTCR adherents and 45 selected non-partners. In this case, all domestically established NewSpace companies that are developing, testing, producing or marketing missile-related technology were mapped. The pilot study further included a case study on small- and micro-launcher projects, with a focus on NewSpace companies leading such projects. Manufacturers of commercial launch vehicles—and, in the NewSpace industry, particularly small and micro launchers—combine most of the know-how, components, equipment, technology and materials required for missiles and are thus particularly sensitive from a non-proliferation perspective.

The research team consulted open-source information provided by national NewSpace and space industry associations, industry databases and analyses, venture capital and funding databases, national space agency projects, reporting in trade journals and—where accessible—company registries. The research team also conducted literature and web searches using keywords drawn from the MTCR annex to identify NewSpace companies developing, testing, producing or marketing missile-related technology. The pilot study was not designed to generate a data set that shows the missile technology capabilities of states or their industrial base, but focused only on NewSpace companies.

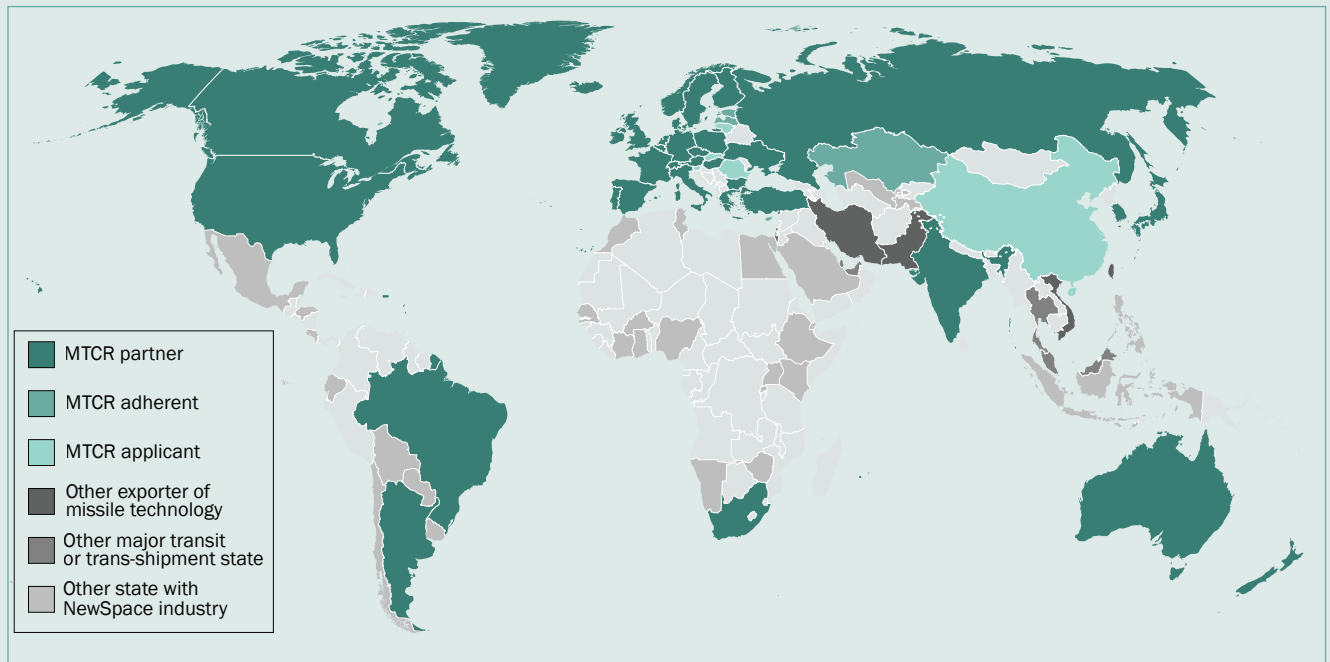


Figure a. States covered by the pilot study

Geographical scope

The pilot study covered a total of 84 states, including all MTCR partners and adherents, several states known to have applied to join the MTCR, established exporters of missile technology, major transit and trans-shipment hubs, and states with an established or emerging NewSpace industry. The selection of states also sought to ensure that the overall sample included all continents and regions and a diversity of small and large and developing and developed economies. The case study on small- and micro-launcher projects covered all states, yet all projects identified are located in states covered by the pilot study.



Definitions

For the purposes of the pilot study, *missile-related technology* is defined as complete missiles and space launch vehicles and any dual-use equipment, software and technology covered by the MTCR annex. This definition also broadly includes emerging production technologies, in particular additive manufacturing technology specially designed for producing components for launch vehicles or missiles, and satellite services offering geospatial data products that are particularly relevant for missile targeting and guidance.

The pilot study defines a *NewSpace company* using a combination of criteria. NewSpace companies have largely been established within the past 20 years; identify with and directly refer to NewSpace in statements, publications and on their websites; use venture capital and other private and public funding sources to finance their operations; and have adopted the lean organizational structure or business culture of start-ups. Not all NewSpace companies share all of these characteristics, but their inclusion in the data set was assessed based on these criteria and whether they develop, test, produce or market missile-related technology.

A state is considered to be a *missile possessor* if it deploys missiles with a minimum range of 100 kilometres and the ability to target ground targets (including anti-ship systems).

^a For full details see Brockmann, K. and Héau, L., *The Expansion of the NewSpace Industry and Missile Technology Proliferation Risks* (SIPRI: Stockholm, Oct. 2024).

components as ballistic missiles. Globally, there is a large number of small- and micro-launcher projects, with launchers currently under development or in operation. The vast majority are implemented by NewSpace companies, resulting in a concentration of missile-related technology. A large share of these companies are established in MTCR partners, but a considerable number are in non-partners. China stands out as the state outside the MTCR with by far the largest number of NewSpace companies that are developing, testing, producing or marketing missile-related technology including as part of small- and micro-launcher projects.

THE STATE OF THE GLOBAL NEWSPACE INDUSTRY USING MISSILE-RELATED TECHNOLOGY

The NewSpace industry in MTCR adherents and other non-partners

The pilot study found that of the 49 mapped MTCR adherents and other non-partners, 27 (i.e. 55 per cent) have NewSpace companies developing, testing, producing or using missile technology established on their territory (see figure 1). Nineteen of these 49 states (39 per cent) have 1–5 relevant companies established on their territory, and six (12 per cent) have 6–10 companies. One non-partner—Israel—was found to have 11–15 relevant NewSpace companies, while another—China—had was found to have 76–100. Seventeen of the 49 mapped adherents and other non-partners have adopted the current or a previous version of the MTCR annex into their national export controls—sixteen of which also have domestic NewSpace companies developing, testing, producing or using missile technology.

Among the mapped adherents and other non-partners, China stands out with the highest number of relevant NewSpace companies (see figure 1). This can in part be attributed to a significant focus on the launch sector within the Chinese space industry and the decision to locate such projects within the NewSpace sector of China's space industry, not the traditional, state-driven portion. Notably, many Chinese small- and micro-launcher companies benefit from technology transfers from state-owned or state-controlled entities

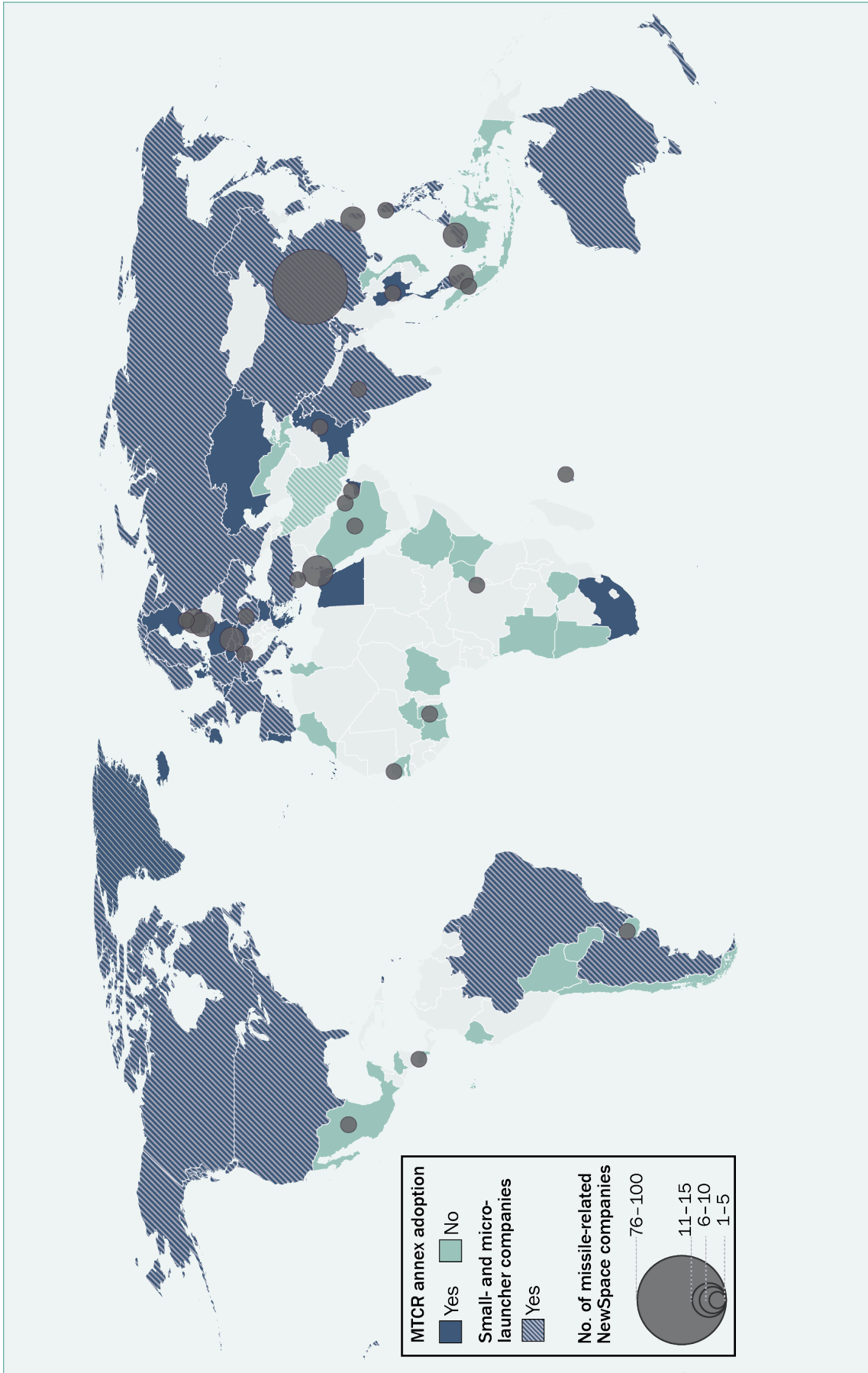


Figure 1. Adoption of the Missile Technology Control Regime annex and estimated number of NewSpace companies developing, testing, producing or using missile-related technology, and small- and micro-launcher companies in adherents and selected other non-partners

Note: The ranges provided here are assessed estimates based on the actual number of companies mapped and taking into account the frequent turnover and founding of companies in the sector.

Source: Data collected by SIPRI.



and from central and regional government funding.² These conditions differ considerably from those in many other states and reflect the specific characteristics of the Chinese commercial space sector.

Missile-related technology in the NewSpace industries of MTCR partners

Of the 35 MTCR partners, only 12 states have domestic NewSpace companies that collectively develop, test, produce or market technology across 13–17 types of the 17 items included in the MTCR annex.³ In 16 of the partners there are companies that collectively develop, test, produce or market goods, technology or software that fall under 8–12 of the 17 items, while 6 partners have companies that collectively develop, test, produce or market 1–7 item types. Only one MTCR partner—Iceland—has no relevant NewSpace company.

This indicates that NewSpace companies have permeated the space sector in many MTCR partners and are developing, testing, producing or marketing a wide range of missile-related technologies and offer required know-how. It should be noted that even if a state has NewSpace companies covering only a small number of annex items, it does not necessarily indicate a lack of technology capabilities. Rather, it may result from many factors, including strong domestic or international competition restricting new entrants in certain technologies; lack of scope for innovative approaches to NewSpace technology in certain item categories (e.g. analogue-to-digital converters); or limited civilian applications (e.g. stealth).

NewSpace industry in states possessing missiles and space launch vehicles

Among the 84 states mapped, 55 possess missiles and 28 have operational SLVs or small and micro launchers currently in development. Of the 55 missile possessors, 44 were also found to have NewSpace companies developing, testing, producing and marketing missile-related technology—this demonstrates a high correlation between a state possessing missiles and having a relevant NewSpace industry. All but one of the 28 states with SLVs or small and micro launchers in operation or under development also have relevant NewSpace companies. This indicates that the NewSpace industry is an increasingly important component of the space industry of spacefaring states and those with ongoing SLV development projects.

PROLIFERATION OF SMALL AND MICRO LAUNCHERS

The number of small- and micro-launcher projects—that is, efforts to develop and produce a launch vehicle with the capability to bring into orbit payloads of up to 500 kilograms (micro launcher) or up to 2000 kg (small launcher)—

² Solem, E., ‘The emergence of China’s commercial space companies and start-ups’, China Aerospace Studies Institute, Sep. 2020, p. 15.

³ The ‘list items’ refer to the 20 numbered item categories across categories I and II included in the MTCR equipment, software and technology annex, 17 of which currently include entries. See MTCR, ‘MTCR guidelines and the equipment, software and technology annex’, [n.d.]; and MTCR, ‘Equipment, software and technology annex’, MTCR/TEM/2023/Annex, 14 Mar. 2024.

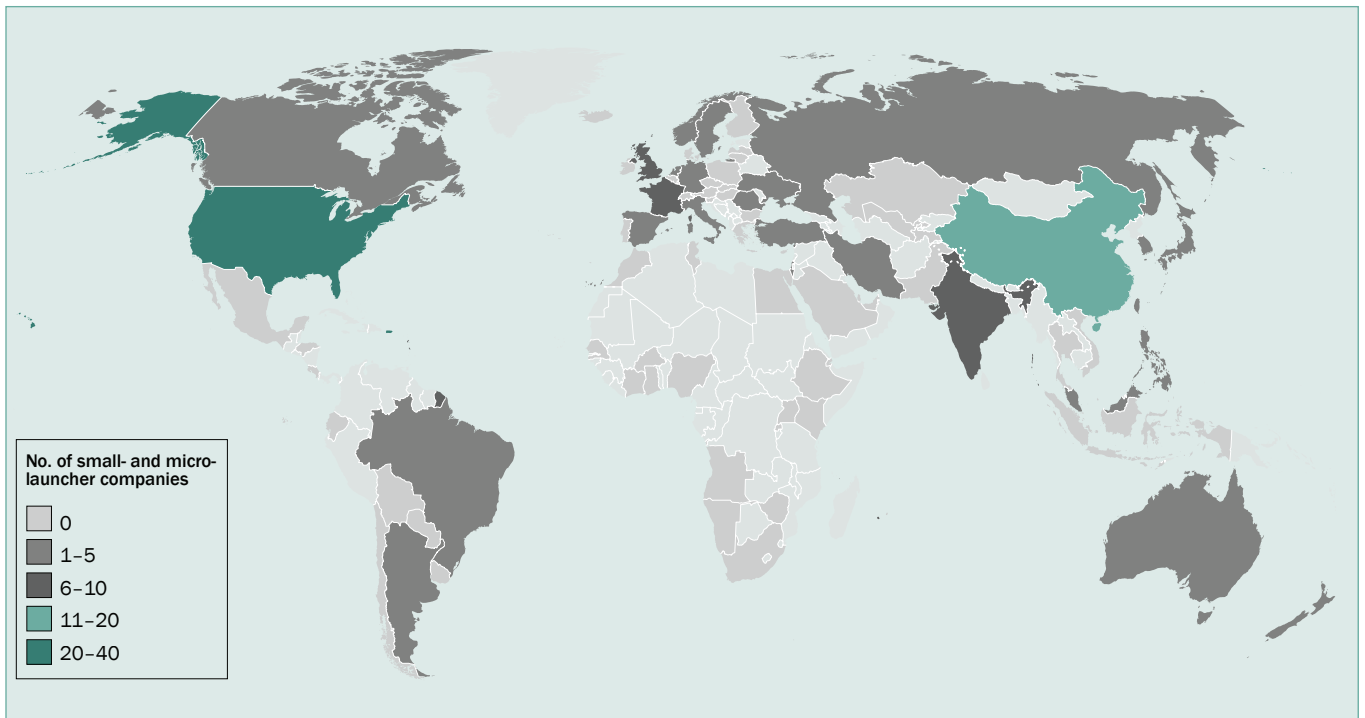


Figure 2. Number of small- and micro-launcher companies, by state

Source: Data collected by SIPRI.

has increased and is spread across a growing number of states. As of October 2024, there are at least 118 active small- and micro-launcher projects globally, including 21 launchers that are operational. These small and micro launchers have been or are currently being developed by at least 111 companies and other entities located in 28 states (see figure 2). The largest number of small- and micro-launcher projects are in the United States (38) and China (16), followed by France (7), India (6), Japan (6), the United Kingdom (6), Germany (5) and Spain (5).

Among the 28 states in which active small- and micro-launcher projects are located, 8 (29 per cent) are non-partners, while 20 of the MTCR partners (but none of the adherents) have such a project. Of the small- and micro-launcher projects identified, 94 (80 per cent) are situated in MTCR partners while 24 (20 per cent) are in non-partners (see figure 3). Each of the eight non-partners with active small- or micro-launcher projects already possesses at least some short-range missiles. The vast majority (98, or 88 per cent) of the 111 entities developing or producing small and micro launchers are NewSpace companies or spin-offs of established companies or national space programmes that are emulating characteristics of a NewSpace start-up.

MTCR MEMBERSHIP, ADHERENCE AND OUTREACH IN THE LIGHT OF THE GROWTH OF NEWSPACE

Eight non-partners are currently developing small- and micro-launcher technology: China, Israel, Malaysia, the Philippines, Romania, Singapore and Taiwan (see figure 2). Aside from small- and micro-launcher projects, a much larger group of states are on their way to developing a missile-related NewSpace industry; at least 27 adherents and other non-partners have at

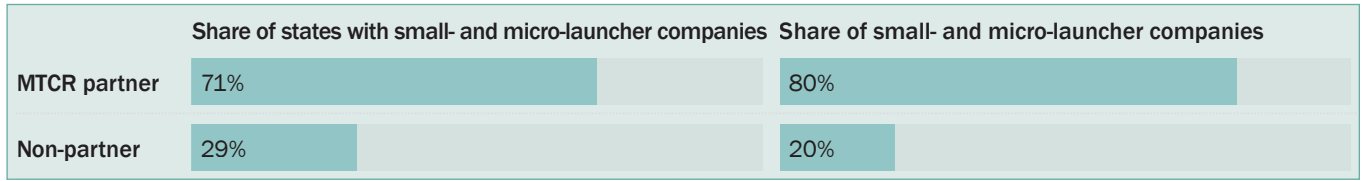


Figure 3. Share of small- and micro-launcher companies established in Missile Technology Control Regime partners and non-partners

Source: Data collected by SIPRI.

least 1–5 NewSpace companies based on their territory that are developing, testing, producing or marketing missile-related technology.

None of the four MTCR adherents have small- and micro-launcher companies on their territories. However, Cyprus, Estonia and Latvia do have emerging NewSpace industries, each with at least 1–5 NewSpace companies developing, testing, producing or marketing missile-related technology on their territory.

The MTCR has recently engaged with a majority of the eight non-partners that have small- and micro-launcher companies: since 2020 the MTCR has held at least one bilateral outreach visit to China (informally), Israel, Malaysia and Singapore, and both China and Romania attended the 2023 technical outreach meeting (TOM) in Oslo. This leaves three of these eight states—Iran, the Philippines and Taiwan—lacking direct engagement with the MTCR.

So far, there appears to have been less of a focus on MTCR outreach directed at the broader group of states with a missile-related NewSpace industry that is only just emerging (i.e., that have 1–5 NewSpace companies developing, testing, producing or marketing missile-related technology). Only 6 of the 19 adherents and other non-partners with such an emerging industry have been involved in some form of MTCR outreach: Cyprus, Mexico, Pakistan, Romania and the United Arab Emirates (UAE) attended the 2023 TOM and the MTCR held bilateral outreach visits to Indonesia, Mexico, Pakistan and the UAE.

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