



RESEARCH SUMMARY

Pathways to Space Research in Russia

The Russian space sector has suffered setbacks since the dissolution of the Soviet Union, but Russia remains a key spacefaring nation. Yet relatively little is known about the educational and career paths for Russian space scientists and engineers and whether Russia has a pipeline of workers to maintain its space enterprise.

Luba Katz, Oleksandr Shykov and Asha Balakrishnan were part of an Institute for Defense Analyses (IDA) team that aimed to close this gap in knowledge by studying career pathways in the space sector; key educational and research institutions for the space industry; and workforce trends in science, technology, engineering and mathematics (STEM) and space-related fields.

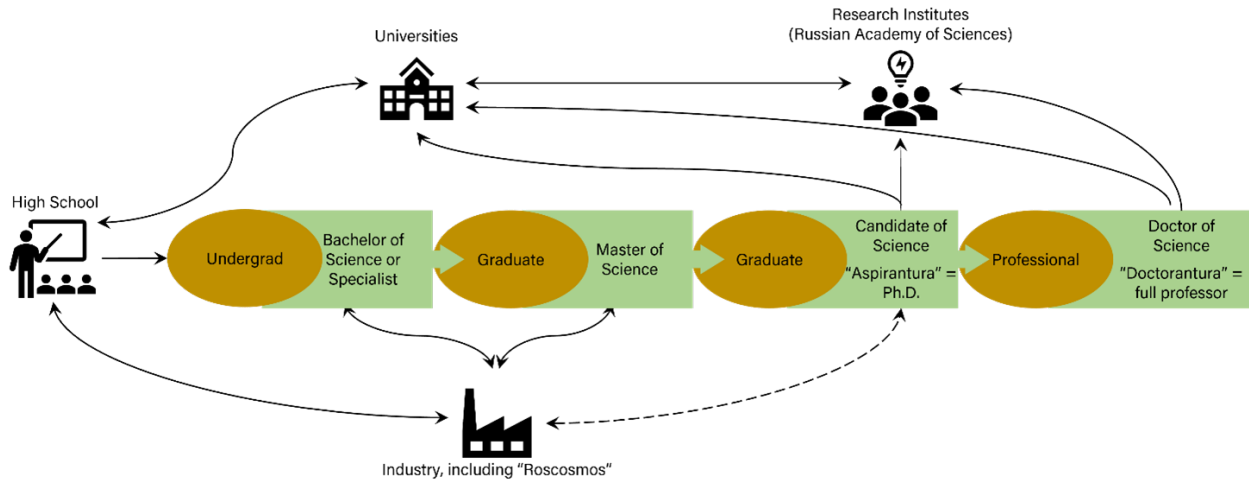
Drawing from English- and Russian-language sources, the IDA team found that educational and employment paths to the Russian space sector are similar to those in the U.S. (see the figure on the next page). The Russian system differs from that of the U.S. in two major ways. First, Russia uses a two-tier qualification schema for doctorate degrees: candidate of science, which is generally accepted as the equivalent of a U.S. doctorate, and doctor of science, which requires at least 10 years

of full-time research and a body of independent scholarship and is granted to a small proportion of science degree candidates. In addition, most educational institutions in Russia narrowly prepare graduates for careers in a specific sector rather than offer a liberal arts education common at U.S. colleges and universities.

Using Russian government data, the researchers analyzed workforce trends across STEM fields and in the space sector and found a consistently negative pattern. The available pool of research and development (R&D) workers and the number

IDA

May 2024 | Product 3002173



of students earning degrees have significantly declined. Indications of space-workforce shortages specifically have also emerged. Additionally, Russia has experienced significant brain drain that began with the fall of the Soviet Union and continues to this day. This brain drain will only intensify with the war in Ukraine. Data on degree production suggests that Russia is unlikely to meet the industry’s demand for highly skilled workers by 2025, even with no further brain drain.

The team identified 74 organizations that play an important role in space education and employment. The list includes universities, several research institutes within the Russian Academy of Sciences, and R&D units within the Russian space agency Roscomos. Case studies of seven universities revealed that they offer many programs in space and space-related fields, with the number of student slots totaling a few thousand per year across degree levels. This output of students may be insufficient, especially if a significant number of graduates do not stay in the space sector, as some literature suggests.

Finally, searches of the Web of Science database yielded over 20,000 English-language publications in space-related journals that listed an author affiliated with a Russian institution. IDA researchers found that 42 percent of publications

included a foreign co-author, but the fraction of these collaborative papers declined from 52 percent in 2010 to 37 percent in 2021. Papers with a foreign co-author garnered significantly more citations than papers with Russian-only authors, suggesting that lack of collaboration is eroding the quality of Russian science.

The IDA team concluded that Russia will struggle to maintain its position in space unless the current workforce trends are reversed and the country reengages with the international scientific community — highly unlikely developments under the current Russian regime.

This summary is based on [IDA D-33069](#).



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