FOREIGN

How science and technology offices linked to the United States Armed Forces fund basic research projects in Brazil

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BOOST

Laboratories and research projects funded and developed by US military institutions

The US is among the world's greatest investors in science and in efforts to bridge theoretical breakthroughs to real-world technological applications. The Department of Defense accounts for an estimated 50% of the country's research and development (R&D) spending—although not every project it funds are conducted inside the US. For at least the last 10 years, the US has funded programs at Brazilian institutions through science and technology (S&T) offices linked to the Armed Forces.

The bulk of these investments are in artificial intelligence, robotics, biotechnology, energy, materials, nanotechnology, opto-electronics, and other cross-cutting technologies (*see* Pesquisa FAPESP *issue no. 306*). "Brazil has high-quality research capabilities that can supplement US S&T efforts," says Kyle Gustafson, a representative from the US Office of Naval Research Global (ONR-G) in Brazil. "Collaborations like these can be mutually beneficial."

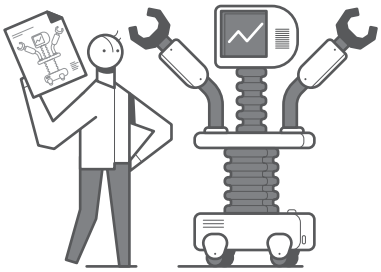
ONR-G and the US Army Combat Capabilities Development Command (DEVCOM) have invested slightly more than US$5.3 million in Brazilian-based projects since 2014. In February 2022, the Southern Office of Aerospace Research and Development (SOARD), an arm of the Air Force Office of Scientific Research (AFOSR), established a permanent presence in Brazil, making the country one of the first to host offices managed by all three branches of the Armed Forces—AFOSR had previously funded research in Brazil for several years, but from its branch office in Santiago, Chile.

Investing in basic science is a long-standing tradition in the US. According to data published in June 2022 by the National Science Foundation, in 2019 alone, the country spent US$102.9

PHOTOS U.S. AIR FORCE

Funding roadmap

Frequently asked questions about applying for funding from US S&T offices

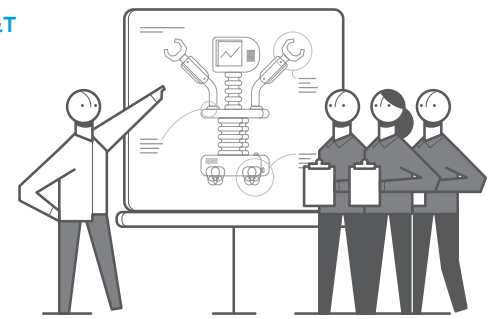


1. WHO IS ELIGIBLE FOR FUNDING?

Researchers conducting basic science research in fields such as artificial intelligence, robotics, biotechnology, energy, materials, nanotechnology, opto-electronics, and other cross-cutting technologies

2. HOW TO APPROACH S&T OFFICES FOR FUNDING?

During S&T office representatives' visits at universities and research institutes, scientific conferences and events, or when researchers contact the offices directly to pitch their projects

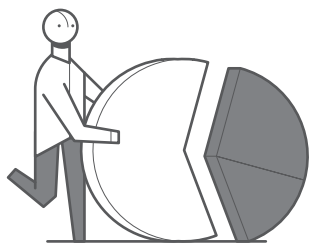


3. HOW DO RESEARCHERS APPLY FOR FUNDING?

Candidates submit a summary of their idea to the relevant office, which then assesses the innovation potential of the project and whether it aligns with the Armed Forces' research interests

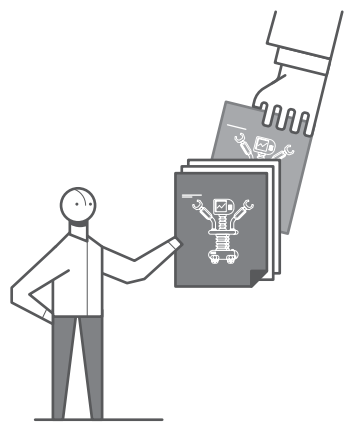
4. WHAT RULES APPLY TO THE USE OF GRANT FUNDING?

Scientists have the discretion to manage their funding; they can use it, for instance, to purchase materials and equipment or to fund graduate fellowships and postdoctoral internships



5. PUBLISHING

Researchers are encouraged to publish results in open access, high-impact journals



6. PATENTS AND INVENTIONS

Researchers and their host universities own the intellectual property rights in the innovations they develop as part of their funded projects, but the US government can use or modify their project deliverables at its discretion in the future

SOURCES ONR-G, DEVCOM, AND SOARD

billion on theoretical research that did not have inherent or immediate applications, with US$33.7 billion (32.7%) of this amount coming from private companies, largely in the pharmaceutical, manufacturing, and information technology industries. Since the 1940s, the Armed Forces have also opened S&T offices in partner nations, creating a global science task force to conduct research in target fields of interest.

In Brazil, research funding received from these offices is largely concentrated in universities and institutions in São Paulo. For instance, of the US$4.5 million in funding provided by ONR-G to Brazilian universities over the last 10 years, US$1.7 million went to institutions in São Paulo, mostly to the University of São Paulo (USP). One of the research grants disbursed during that period went to a project for the development of low-cost ventilators, led by Marcelo Zuffo and Raul Gonzalez Lima at the Polytechnic School at USP. With the US$200,000 provided by ONR-G and additional funding given by other donors, the researchers there produced up to 20 ventilators per day during the worst of the pandemic.

Brazilian researchers say that the outside funding has helped them continue their research during a period in which public funding has been in short supply. For Bojan Marinkovic, in the Chemical and Materials Engineering Department at the Pontifical Catholic University of Rio de Janeiro (PUC-RJ), these grants have become the primary source of funding for his laboratories. Since 2014, he has used DEVCOM grants to research ceramic materials exhibiting negative or near-zero thermal expansion. "We want to understand how they work so in the future they can be used to develop parts for construction and military applications that are resistant to abrupt tempera-

INFOGRAPHIC ALEXANDRE AFFONSO

ture swings," he says. Isabel Cristina Carvalho, a physicist at the Opto-electronics Laboratory in the Physics Department at PUC-RJ, has similarly received ONR-G funding since 2015 for research on localized surface plasmon resonance, an optical phenomenon that occurs when light interacting with metal nanoparticles causes the collective excitation of electrons, allowing certain wavelengths (colors) to be absorbed.

Pierre-Louis de Assis, at the Gleb Wataghin Institute of Physics at the University of Campinas (IFGW-UNICAMP), has used such funding to buy equipment and maintain postdoctoral fellowships. "Toward the end of 2019, we were awarded a grant from SOARD to purchase single photon emitters using two-dimensional semiconductors for integration into quantum computing chips," he says.

Science office representatives regularly visit universities and scientific institutes throughout Brazil to present funding opportunities. At these events, Brazilian researchers are given a few minutes to pitch their projects and make the case for why they are important. "We also attend conferences and use search tools such as Web of Science to prospect for scientists working in target fields," says Rosa Santoni, a DEVCOM representative in Brazil. "When we find a project we think has potential, we contact the lead researcher and ask them to submit a summary proposal so we can assess its innovation potential and whether it aligns with the Armed Forces' priorities." If the proposal looks promising, the researcher then submits a complete proposal specifying how much funding will be needed for continued development and what outcomes can be expected.

Selected projects are typically awarded a grant of US$25,000 to US$140,000 per year, sometimes a greater amount based on the level of interest. Brazilian researchers also receive an allowance to attend national and international conferences, organize seminars and workshops, and visit universities and institutions in the US or even research facilities run by the US Armed Forces. Researchers are free to conduct their research and use the funding at their discretion. Project success is measured in terms of the number of papers published. "We encourage researchers to publish their results in open access, high-impact journals," says Santoni. The researchers and their host universities own the intellectual property rights in the innovations they develop as part of their funded projects. "But their contract allows the US government to use or modify their project deliverables at its discretion in the future," she says.

Investments in Brazilian research efforts in strategic fields can help to expand the pool of innovations that the US can leverage in its security programs in the future. "This is also a way to build closer cooperation and expand US geopolitical influence in a bid to contain Chinese and other nations' growing foothold in the region," says Amâncio Jorge de Oliveira, executive coordinator at the School of Scientific Diplomacy and Innovation and a professor at the Center for International Negotiations Research at the USP Institute of International Relations.

Oliveira notes that the US has a long-standing tradition of using science as an instrument of foreign policy. In the 1970s, it used scientific diplomacy to forge closer ties with China. More recently, the US used the same strategy to develop collaborations with Cuban scientists for research on cancer and hurricane forecasting. "The United States recognizes the importance of international collaboration with reliable partners to solve future problems, explore new technologies, and build enduring relationships with foreign scientists," says Gustafson. "We believe it's important to pool resources, amplify scientific research, and support experimentation and new opportunities."

In addition to providing funding for research, another benefit from the partnership is the opportunity, in some cases, to access military research facilities in the US. "We recently sent a master's degree student to an Army laboratory in Maryland," says Marinkovic at PUC-RJ. The US Armed Forces regularly organizes events and invites Brazilian researchers to talk about their work. "In the coming days, I'll be delivering a lecture at the Air Force Office of Scientific Research," says Luís Gustavo Marcassa, a professor at the São Carlos Institute of Physics (IFSC) at USP, who is currently doing research about Rydberg atoms—atoms whose electrons orbit up to 10,000 times further from the nucleus than normal—and their potential applications in quantum computing and developing more accurate microwave sensors.

Although foreign funding is welcome, it provides only part of the amount needed for the full spectrum of research activities. "For us, researchers in São Paulo, FAPESP remains our core source of funding, but the grants we receive from US S&T offices provide a valuable funding supplement, especially for master's, doctoral, and postdoctoral fellowship programs," he says. Amâncio Oliveira adds that access to these grants can also help Brazilian scientists produce world-class research. "This can strategically position Brazil within the international research ecosystem and raise its profile on the global science scene." ■