



SECURE
WORLD
FOUNDATION

2022 ANNUAL REPORT

SECURE WORLD FOUNDATION

Annual Report 2022



SWF VISION

Secure World Foundation envisions the secure, sustainable, and peaceful uses of outer space, contributing to global stability and benefits on Earth.

SWF MISSION

The mission of the Secure World Foundation is to work with governments, industry, international organizations, and civil society to develop and promote ideas and actions for international collaboration that achieve the secure, sustainable, and peaceful uses of outer space, benefitting Earth and all its peoples.

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LETTER FROM THE FOUNDER

Oh my! The amazing photos coming out of the James Webb telescope in 2022! Who isn't inspired by the beauty of our universe that we live in?

Looking to space has been humankind's inspiration since the beginning of our existence. Our religions, spirituality, and faith have always looked to the Heavens.

Poetry, love, and art have all drawn on its beauty.

This universal inspiration of space was one of the motivators in choosing Secure World Foundation's mission. It is our belief that by drawing on our common heritage and connection through space, humankind can work together to create

the secure, sustainable, and peaceful use of outer space for the benefit of us all. Looking out into the universe, we marvel at the possibilities. Looking back at Earth from space, we see our fragility and our beauty. We can also see the possibilities – gaining new knowledge, finding solutions, opportunities for collaborating.

As you see in our Annual Report, SWF approaches this with focused, practical, and realistic actions that are moving us along that path, and we welcome you to join us. Let's use our universal connection to space to safeguard our children's future inheritance and create a more secure world for them here on Earth.

Cynda Collins Arsenault
President and Co-founder



Pillars of Creation, Credit: NASA, ESA, CSA, STScI

LETTER FROM THE EXECUTIVE DIRECTOR

The mission of the Secure World Foundation is to work with governments, industry, international organizations, and civil society to develop and promote ideas and actions for an international collaboration that achieves the secure, sustainable, and peaceful uses of outer space, benefitting Earth and all its peoples. The Secure World Foundation's programs translate this mission into actions aimed at raising the salience of space sustainability, building common understandings of complex issues, facilitating dialogue, and promoting cooperative governance of space activities at the national and international levels.

This Annual Report provides an overview of Secure World Foundation's work during 2022. In it, you will find highlights of our work to support dialogues in the United Nations on norms of responsible behavior, our ongoing research on global counterspace capabilities, our work to enhance inter-regulator dialogues, and the 4th Summit on Space Sustainability, to name but a few. All told, SWF completed 142 projects and activities in 15 countries on 6 continents.

One of the key strengths of SWF is our convening power, manifested in the many events and dialogues we host each year. Following a two-year suspension from hosting

in-person events due to the COVID-19 pandemic, in 2022, we returned to hosting in-person events but retained a strong element of virtual participation, building on lessons learned during the pandemic. We will continue to maintain the option for virtual participation in many of our events going forward. I would like to take this opportunity to acknowledge and thank the dedicated staff of SWF for initiating and driving the activities highlighted in this report. I would also like to recognize and thank our many partners and sponsors who walked the uncertain road of 2022 together with us as we returned to hosting in-person events. Last but not least, I would like to thank our President, the Board, and the Advisory Committee for all their support during the year.



Whatever the future may bring, we will continue to be guided by our belief that international cooperation and partnerships are key to preserving outer space as an environment for peaceful use and exploration for the benefit of all nations.

Peter Martinez
Executive Director

PROGRAM SPOTLIGHTS

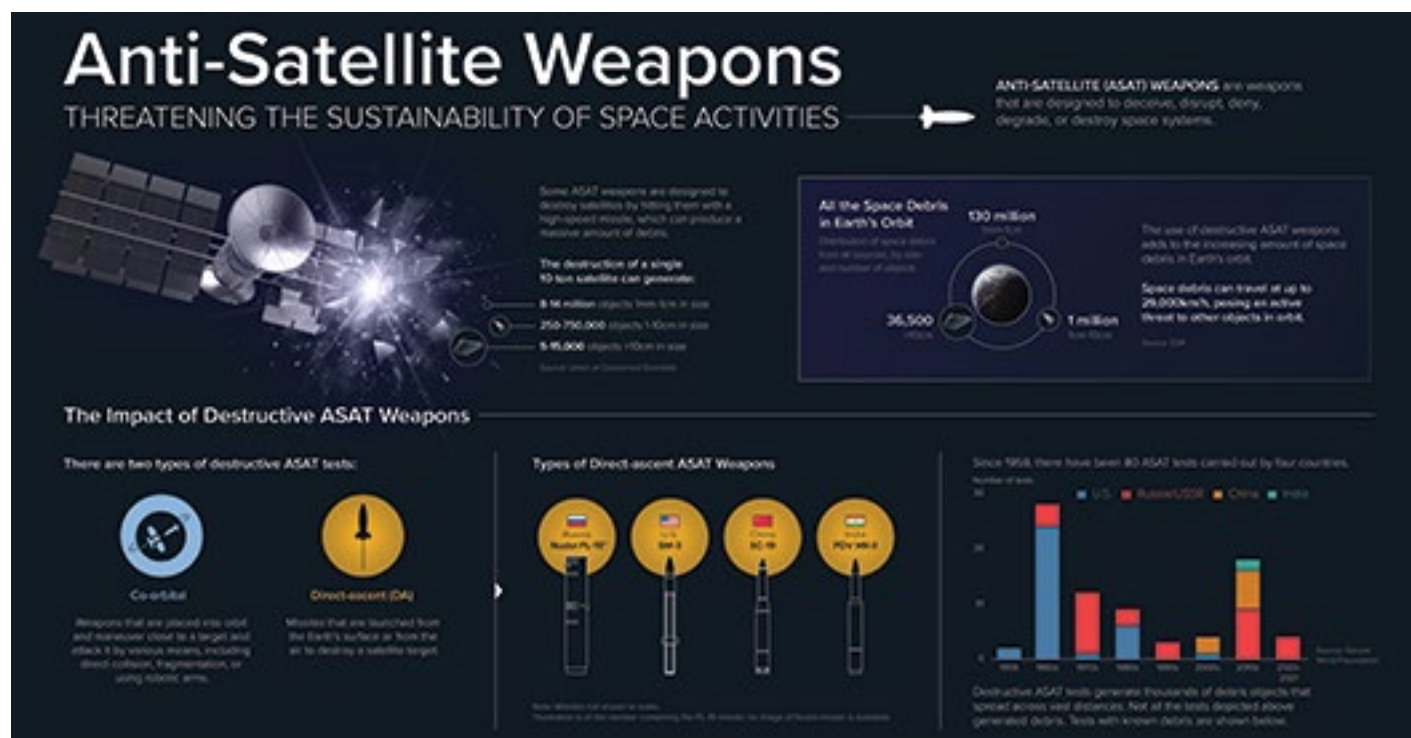


UN OEWG support

SWF was honored to participate in the first two meetings of the United Nations' Open-Ended Working Group on Reducing space threats through norms, rules and principles of responsible behaviours, or OEWG for short. Held in May and September 2022, SWF staff were asked to give presentations about voluntary mechanisms and regimes applicable to outer space (Peter Martinez) and current and future Earth-to-space threats by States to space systems (Victoria Samson). SWF also participated as a civil society observer for this OEWG process. This OEWG is important as it represents an evolution in how the Geneva diplomatic community discussed space security issues, attempting to kick-start a process that has been moribund for decades because States disagreed about what the biggest threats were to space security and how to go about meeting those threats.

Our Work with the Republic of Korea

A few weeks after the May 2022 meeting of the OEWG, SWF co-organized with the Republic of Korea and the United Nations Institute for Disarmament Research (UNIDIR) a virtual conference on May 23–24 which was intended to foster dialogue towards a common understanding on responsible behaviors within countries from the Association of Southeast Asian Nations (ASEAN). Dialogue across panels recognized past efforts to address space security concerns and extracted lessons learned for future initiatives. In addition, panelists reflected on the possible value and synergy to be gained by discussing the concurrent efforts taking place in the United Nations context on space safety and security. The event heard a discussion on the potential and limits of norms, rules, and principles in keeping space activities secure and sustainable. There were also definitional proposals for what constitutes responsible



and irresponsible behaviors. It was highlighted that binding and non-binding outcomes are not mutually exclusive, and that the latter can serve as the foundation for binding agreements. Panelists considered the role of other stakeholders, notably the largest group of actors in outer space—the commercial space industry. The event heard concrete suggestions on ways to develop the future of the space security architecture from members of non-governmental sectors. Importantly, panelists left the event having brainstormed new initiatives to act on, such as increased network mapping to enhance cross-sectoral dialogue. *Scan/Click Here to view a summary report of the event*

(ASAT) weapons. Some ASAT weapons are destructive in nature, physically striking an object in space and causing it to break up. Historical testing of these destructive weapons has contributed significantly to the amount of debris that exists in orbit, posing a threat to all objects in space. While no country has ever attacked another country's space object in this way, the mere testing of destructive ASAT weapons represents some of the most significant debris-generating events in history that are creating problems for operational satellites today. To date, four countries have conducted destructive ASAT tests: the United States, Russia (U.S.S.R.), China, and India. This infographic demonstrates the types of ASAT weapons that have been tested and shows how the force of impact can propel the debris to much higher altitudes than the original point of impact, making it much more long-lived and, therefore, more threatening to all users of space data. *Click/scan the QR code to view the full infographic.*

Later in the year, with the support of the government of the Republic of Korea, Secure World Foundation also developed an infographic developed in partnership with Visual Capitalist on the debris created by anti-satellite



SWF's Open-Source Report on Global Counterspace Capabilities

In April 2022, SWF published the fifth edition of its Global Counterspace Capabilities report, an annual open-source assessment of the spectrum of counterspace capabilities being developed by multiple countries. In order to highlight destructive anti-satellite testing and the negative effects it can have on the space environment, the report was reorganized into countries that have created space debris through ASAT testing by year of first test (US, Russia, China, India); countries that are engaged in counterspace R&D (Australia, France, Iran, Japan, NK, SK, UK); and cyber capabilities. We also added Arabic to the list of translations (along with existing French, Mandarin, Spanish, and Russian).

The goal of the Global Counterspace Capabilities report is to create a reference document that fosters a more open and public debate on the implications of conflict on Earth extending into outer space. Over the last several years, there has been growing concern from multiple governments over their reliance on vulnerable space capabilities for national security and the corresponding proliferation of offensive counterspace capabilities that could be used to disrupt, deny, degrade, or destroy space systems critical to national security. This, in turn, has led to increased rhetoric from some countries about the need to prepare for future conflicts on Earth to extend into space, and calls from some corners to increase the development of offensive counterspace capabilities and put in place more aggressive policies and postures.

TABLE 5-1 – ORBITAL DEBRIS CREATED BY ASAT TESTS IN SPACE

DATE	COUNTRY	ASAT SYSTEM	TARGET	INTERCEPT ALTITUDE	TRACKED DEBRIS	DEBRIS STILL ON ORBIT	TOTAL DEBRIS LIFESPAN
Oct. 20, 1968	Russia	IS	Cosmos 248		252	79	50+ years
Oct. 23, 1970	Russia	IS	Cosmos 373		147	35	50+ years
Feb. 25, 1971	Russia	IS	Cosmos 394		118	45	50+ years
Dec. 3, 1971	Russia	IS	Cosmos 459		29	0	3.3 years
Dec. 17, 1976	Russia	IS	Cosmos 880		127	57	45+ years
May 19, 1978	Russia	IS-M	Cosmos 970		73	64	40+ years
Apr. 18, 1980	Russia	IS-M	Cosmos 1171		48	6	40+ years
Jun. 18, 1982	Russia	IS-M	Cosmos 1375		64	60	35+ years
Sept. 13, 1985	U.S.	ASM-135	Solwind	530 km	287	0	18+ years
Sept. 5, 1986	U.S.	Delta 180 PAS	Delta 2 R/B		17	0	< 1 year
Dec. 26, 1994	Russia	Naryad-V?	Unknown		27	24	25+ years
Jan. 11, 2007	China	SC-19	FengYun 1C	880 km	3536	2786	15+ years
Feb. 20, 2008	U.S.	SM-3	USA 193	220 km	175	0	1+ year
Mar. 27, 2019	India	PDV-MK II	Microsat-R	300 km	130	1	3+ years
Aug.-Dec. 2019	Russia	Cosmos 2535	Cosmos 2536		30	16	3+ years
Nov. 15, 2021	Russia	Nudol	Cosmos 1408	470 km	1790	300	Unknown
Total					6850	3472	

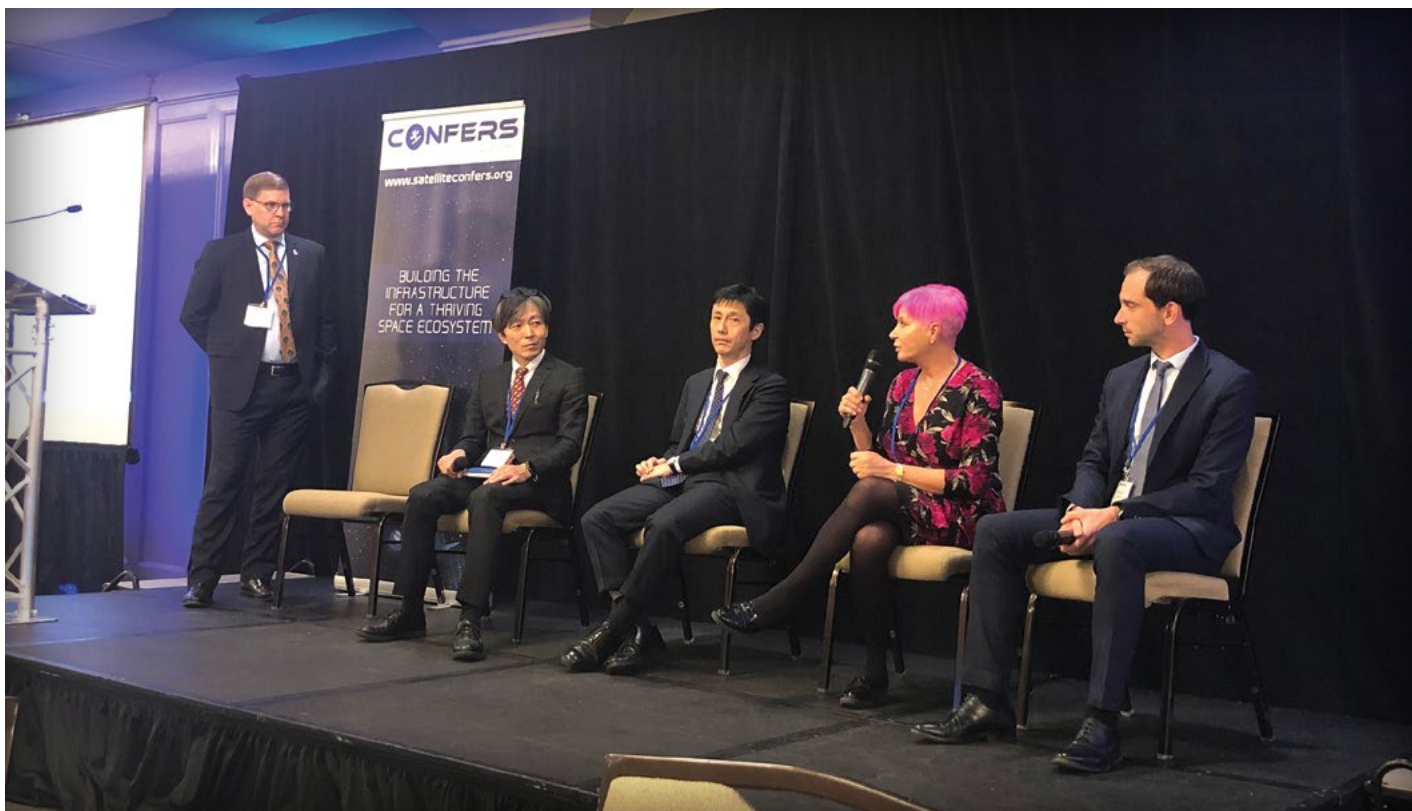


Wrapping Up Our Support for CONFERS

Since October 2017, Secure World Foundation has, along with Advanced Technology International (ATI) and the Space Infrastructure Foundation (SIF), served as the Secretariat for the Consortium for Execution of Rendezvous and Servicing Operations (CONFERS). CONFERS is an industry-led initiative, with initial seed funding provided by the U.S. Defense Advanced Research Projects Agency (DARPA), that aims to develop and publish non-binding, consensus-derived technical and operations standards for commercial satellite servicing

activities and to facilitate the development of a satellite servicing ecosystem.

2022 was the fifth and final year of SWF's support to CONFERS and one that saw it transition to a self-supporting activity that can stand on its own. Membership expanded to more than 20 industry members from across the globe, and CONFERS was foundational in the creation of ISO 24330, the first international standard on satellite servicing published in June 2022. CONFERS also initiated the development of two more standards - spacecraft fiducial markers to support rendezvous and proximity operations (RPO) and prepared in-space refueling systems - that are currently being worked on by the American Institute of Aeronautics and Astronautics (AIAA) Committee on Standards.



Development of The COPUOS Briefing Book

The Secure World Foundation engaged Fulbright Scholar Michael Friedl as a Research Associate to work with Chris Johnson to draft a primer on the history, structure, and workings of the Committee on the Peaceful Uses of Outer Space (COPUOS). Designed as a practical resource, SWF began developing the COPUOS Briefing Book as an essential guide, clarifying COPUOS's complex proceedings with the goal of facilitating increased understanding and participation among new delegations. It will highlight the Committee's role in developing norms for peaceful outer space activities while providing insights into its nuanced discussions and diplomatic exchanges. The book will benefit a broad audience, anticipating increased global

participation in space treaties and intended to foster future thought leaders dedicated to maintaining space for peaceful purposes.

SWF plans to launch the COPUOS Briefing Book in June 2023, aligned with the 2023 UN COPUOS session in Vienna. SWF will offer copies of the book to delegates in attendance and at SWF's Summit for Space Sustainability. The combined efforts aim to ensure that the COPUOS Briefing Book becomes a valuable resource for new and existing participants, contributing to the informed and peaceful use of outer space.

Supporting Young Professionals

SWF fostered the next generation of space leaders through two key initiatives in 2022: the Dr. Michael



Simpson Scholarship Fund and the Space Sustainability Research Fellowship program.

The Dr. Michael Simpson Scholarship Fund, previously known as the International Astronautical Congress (IAC) Scholarship Program, aims to propel the careers of young professionals in the space sector. This year, we proudly supported five promising professionals to attend the 2022 IAC in Paris. Of more than 70 competitive abstracts received globally, these five scholars stood out, reflecting their potential to invigorate the space community with their fresh perspectives and innovative ideas.

SWF also welcomed its inaugural cohort of Space Sustainability Research Fellows, whose goal was to explore critical aspects of space sustainability. Claire Oto, Senior Policy Analyst at the University of Virginia's National Security Policy Center, studied current literature on space

sustainability, identified gaps in mechanisms, institutions, and stakeholders, and proposed an approach to implementing polycentric governance concepts.

Daniel Patton, an Environmental Specialist in Huntsville, Alabama, delved into the question, "Is Outer Space a Global Commons?" His research focused on defining this concept, discerning if space is a 'global commons' or 'common pool resource,' and identifying actors who perceive space in these terms. His work also examined the implications when some stakeholders view space as a commons while others do not.

By investing in young talent through these programs, SWF is facilitating the integration of new ideas into the space sector, enhancing the professional growth of these future leaders, and, ultimately, strengthening the long-term sustainability of outer space activities.



Regulator-to-Regulator Dialogue on Orbital Carrying Capacity

SWF led a project to share information and raise awareness with regulators and policy-makers about orbital carrying capacity in light of the increasing deployment of large satellite constellations and the oversight challenges they present. Large LEO constellations pose numerous unique challenges for regulatory processes primarily designed to administer spectrum access, coordination, and interference matters. This project brought together national regulators from multiple countries (along with technical experts) to discuss with each other these challenges, their approaches to licensing large constellations, and potential solutions, with a case focus on the topic of orbital carrying capacity. Orbital carrying capacity can be loosely described as a quantification of the amount of activity specific orbital regions can sustain.

HIGHLIGHTS OF THESE EFFORTS INCLUDE:

Workshop to Assess Status of Orbital Carrying Capacity Research: This March 2022 workshop brought international researchers together to share the status of current research on orbital carrying capacity and measuring orbital congestion. SWF used outcomes from this workshop to inform later regulator dialogues and events.

June Regulator-to-Regulator Dialogue: This full-day June 2022 workshop in London brought regulators together to discuss the oversight of large constellations and orbital carrying capacity. The event successfully opened a dialogue about managing large constellations, built new connections between regulators, and raised awareness about orbital carrying capacity.



Regulator-to-Regulator Dialogue at the International Astronautical Congress (IAC): Held on the margins of the IAC in Paris in September, this second workshop on orbital carrying capacity brought together regulators from different countries to discuss challenges and potential solutions.

The project, which is ongoing, seeks to foster international dialogue and cooperation related to technical assessments of orbital carrying capacity research and its application to best practices in regulatory oversight. Outcomes from these events underscored a need for more regulator-to-regulator dialogue, including between space environment regulators and spectrum oversight authorities, and the

need to enhance interchanges between policymakers/regulators and the technical research to build an understanding of the possible regulatory and policy relevance of orbital carrying capacity assessment.

These activities realized many of SWF's short-term objectives by facilitating critical conversations and raising awareness. It also moved its longer-term goals by building relationships between regulators, satellite operators, and the research community working on orbital carrying capacity assessment and modeling. SWF's activities in this project continue in 2023, with a noted need to increase participation and engagement with regulators involved in spectrum management and oversight.



Panel discussion at the 4th Summit for Space Sustainability

4th Summit for Space Sustainability

The Secure World Foundation held the 4th Summit for Space Sustainability in June 2022. For the first time outside the United States, the Summit took place in London and was co-hosted with the United Kingdom Space Agency. The event drew an impressive attendance of 617 on-site and virtual participants, initiating meaningful conversations on global space sustainability.

The conference addressed diverse challenges related to space sustainability, which, despite increasing recognition, sees disjointed progress. The Summit's primary goal is to break down the "silos" within the space policy community and stimulate discussions toward tangible policy results.

Focusing on "Global Priorities for Space Sustainability," the 2022 Summit was a two-day conference exploring a range of themes. It showcased current trends in space sustainability while also probing into future steps for advancement. Some of the covered topics included:

- Orbital capacity and the current state of knowledge regarding orbital carrying capacity and space environment thresholds.
- Space Traffic Management (STM), through the lens of American and European Union frameworks.
- Banning the deliberate creation of space debris through direct ascent anti-satellite tests.

- Living in LEO, the gaps in existing regulatory and legal regimes and how to make certain sustainability is considered with the evolving use of LEO.
- Active Debris Removal (ADR) and the drive to focus on mitigation of debris creation through satellite design, operations, and de-orbiting practices.
- Lunar governance and the competing drives of lunar actors participating in cutting-edge lunar activities.

The event accommodated in-person and virtual participation to extend its reach, with all discussions recorded and made available on YouTube. In addition, the conference made significant efforts to promote young professionals, connecting more than 80 YPs at the conference with industry leaders and mentors in attendance.

The high-profile event featured several important announcements from Minister George Freeman and His Royal Highness Prince Charles, reflecting the significant standing of space sustainability in the UK. Dr. Paul Bate, CEO of the UK Space Agency, commended the Summit as a crucial milestone for the UK's strategic plans on space sustainability. Dr. Bate applauded the event for cultivating business connections, sparking conversations on novel topics, and fostering new collaborations across different sectors.

The 4th Summit for Space Sustainability marked a significant step in SWF's commitment to advancing space sustainability. Its success in facilitating vibrant discussions and promoting collaborations advanced the conversation around space sustainability.

UN Panel Discussion Co-hosted SWF and the Costa Rican Permanent Mission to the UN

SWF and the Costa Rican Permanent Mission to the UN co-hosted a critical panel discussion at the United Nations (UN) Headquarters in October. Titled "For the Benefit of Humankind: Understanding How Space Activities Improve Life on Earth," the event emphasized the crucial role of space-based services in addressing global crises and advancing sustainable development.

Intended to inform UN delegates, the discussion underscored how space activities support significant UN initiatives like the Development Goals and the Secretary-General's "Our Common Agenda." The panel also highlighted the importance of space sustainability, linking it to broader discussions on space security and safety within UN bodies such as the Committee on the Peaceful Uses of Outer Space and the Open-Ended Working Group on reducing space threats.

This collaboration between SWF and the Costa Rican Permanent Mission to the UN raised awareness about space activities' multifaceted benefits, encouraging a broader focus on space matters amidst pressing global issues. The event underscored the importance of integrating space-based solutions into global policy decisions to improve life on Earth.

OUR PARTNERS

Almost all of the work of SWF is done in partnership with other organizations. We work with governments, academia, civil society, intergovernmental organizations, and companies to marshal the voices, perspectives, and

resources that are critical to achieving our vision and mission. Partnerships are at the heart of SWF's way of doing business, and in 2022 we partnered with over 100 entities from around the world.



Where SWF's 2022 Partners Were Located

A SELECTION OF SPONSORS AND PARTNERS

The Aerospace Corporation	OrbitFab
AstroAgency	Paris Peace Forum
Astrosat	Pacific Basin Economic Council (PBEC)
Australia Ministry of Foreign Affairs	Project Kuiper/Amazon
BASIC	Republic of Korea Ministry of Foreign Affairs
Bryce Tech	Rocket Lab
Caelus Foundation	Royal United Services Institute (RUSI)
Catapult Space Applications	SatNews
Center for Strategic and International Studies	SDA Bocconi School of Management
CGI	SERCO
Chinese Academy of Science	Space Court Foundation
Clearspace	Space Forge
COMSPOC Corp.	Space Generation Advisory Council
Costa Rican Ministry of Foreign Affairs	Space Logistics
CU Boulder	SpaceNews
ExoAnalytic Solutions	SpaceWatch.Global
Fortitude	Surrey Satellite Technology
Georgetown Space Law Society	UK Students for the Exploration and Development of Space (UKSEDS)
Global Network on Sustainability in Space (GNOSIS)	UK Space Agency / UK Government
GVF	Uni. of Edinburgh
Harwell Campus	Uni. of Hull
International Institute of Air and Space Law (IIASL)	Uni. of Luxembourg
Inmarsat	Uni. of Mississippi
LEO Labs	Uni. of Southampton
Leuven Centre for Global Governance	The United Nations Disarmament Research (UNIDIR)
Maui Economic Development Board	United Launch Alliance
Maxar Technologies	United Nations Office for Outer Space Affairs (UNOOSA)
Middlebury College	UT Austin
Northern Space	Venture Capital Institute
Northumbria Uni.	Viasat
OneWeb	Virgin Orbit
Open University	

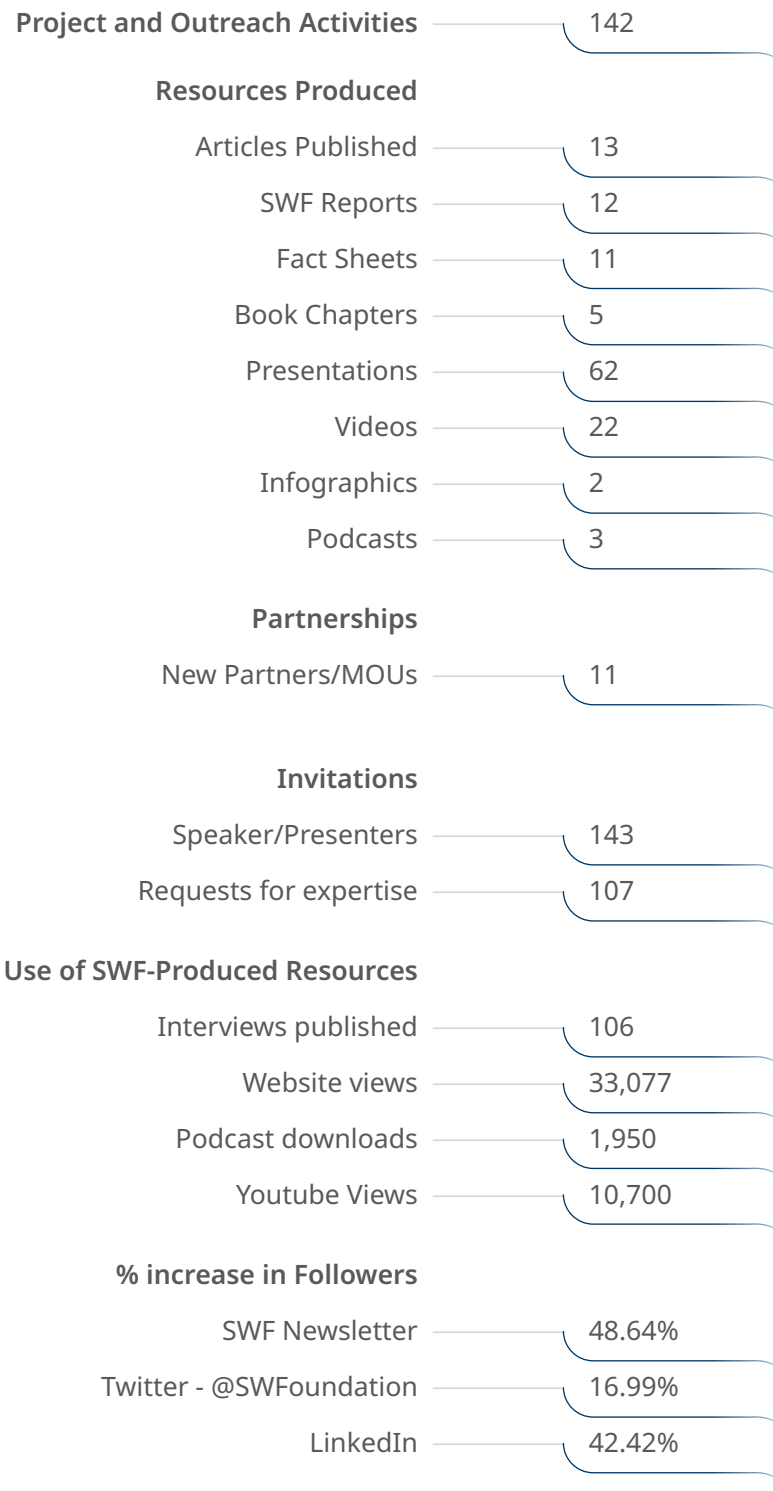
2022 FINANCES

INCOME AND EXPENDITURE

Endowment Draw	\$2,185,454
Program Income	\$235,825
Total Income from All Sources	\$2,421,279

Staff Time on Projects	\$1,044,056
Staff Time on Admin/Ops	\$261,014
Projects	\$605,014
General Operations	\$225,410
Office Expenses	\$115,773
Total Expenses from All Sources	\$2,251,267

SWF PROGRAM ACTIVITIES BY THE NUMBERS



OUR TEAM

Board, Advisory Committee, and Staff Changes in 2022

Board

William V Parker was elected to the SWF Board of Directors.

Dr. Angie Bukley was elected to a second term and continues to serve as Secretary.

Advisory Committee

Dr. Beyza Unal and **Dr. Jessica West** joined the SWF Advisory Committee.

STAFF

Dr. Peter Martinez, Executive Director

Jihan Asher, Communications and Operations Associate (Until 30 April)

Krystal Azelton, Director of Space Applications Programs

Elizabeth Blevins, HR Manager and Executive Assistant for Dr. Peter Martinez

Ian A. Christensen, Director of Private Sector Programs

Lisa Croy, Operations Director

Bailey Geist, Operations Associate

Christopher D. Johnson, Space Law Advisor

Chris Ludwig, Finance Manager

Kelly Moulton, Bookkeeper (From 11 May)

Daniel Porras, Director of Strategic Partnerships and Communications

Victoria Samson, Washington Office Director

Tamara Tanso, Washington Office Operations Associate (From 7 November)

Dr. Brian Weeden, Director of Program Planning

Advisory Committee

Ms. Ariane Cornell

Ms. Laura Delgado López

Mr. Bruce McClintock

Ms. Elina Morozova

Dr. Xavier Pasco

Ms. Ruth Pritchard-Kelly

Dr. Rajeswari Rajagopalan

Dr. Bruno Sánchez-Andrade Nuño

Dr. Beyza Unal

Dr. Guoyu Wang

Dr. Jessica West

With our deepest thanks to Dr. Rajeswari Rajagopalan and Dr. Xavier Pasco for their guidance and support during their two terms as SWF Advisors.

Board

Cynda Collins Arsenault, President, and Co-founder

Marcel Arsenault, Vice President, Treasurer, and Co-founder

Dr. Angie Bukley, Secretary

William Van Rensalier Parker, Community Member

Dr. Michael K. Simpson, Community Member

Marcia S. Smith, Community Member



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