

**NASA's OFFICE OF TECHNOLOGY,
POLICY, AND STRATEGY**

A YEAR IN REVIEW 2022

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All the photos in this report are from NASA unless otherwise indicated.

AN IMPACTFUL FIRST YEAR FOR OTPS

A LETTER FROM ASSOCIATE ADMINISTRATOR BHAVYA LAL

In October 2021, NASA Administrator Bill Nelson sent a letter to the White House and Congress requesting the creation of a new office. His goal was to enable more focused NASA leadership on technology, policy, and strategy matters.



The Office of Technology, Policy, and Strategy (OTPS) was subsequently established within the Office of the Administrator from the merger of the previous Offices of the Chief Technologist and Strategic Engagement and Assessments. The chief technologists at all 10 NASA Centers are part of the OTPS extended family. The overarching goal of OTPS is to provide strategic advice, supported by independent assessments and rigorous analysis, to inform NASA senior leadership on key areas to align mission and agency-level activities. Working transparently across NASA and collaborating with the broader space community, OTPS research and analysis informs NASA’s most consequential decisions about its future.

Soon after the creation of the Office, the OTPS team came together to articulate five principles to guide our day-to-day activities and long-term outlook. Building on the NASA values of safety, integrity, teamwork, excellence, and inclusion, we adopted the following:

- **Customer Focus:** OTPS provides objective, evidence-driven analyses to drive technology, policy, and strategy decisions through focused projects with defined questions and deliverables that are responsive to the needs of NASA’s leaders.
- **Focus on the Future:** We deliver analyses on emerging issues that will profoundly impact NASA across multiple time horizons and help shape the future of space exploration.
- **Collaboration:** Our diverse team of experts in technology, policy, and strategy work in partnership with each other, NASA Mission Directorates, centers, and the broader space community.
- **Transparency:** When our final deliverables are complete, we commit to sharing our work as broadly as possible.
- **Growth Mindset:** All OTPS team members can contribute to NASA’s goals and develop professionally. With rotating study roles, they can display leadership, grow their skills, and engage with the external space community.

In our first year, OTPS came together as a high-performing team to complete more than 15 rigorous, unbiased, data-driven studies, with over two dozen more in progress. Each study involves colleagues from around NASA as either study team members or reviewers. This significant work supports key agency initiatives such as the Moon to Mars blueprint objectives, space sustainability, and the future of NASA. We disseminated our work far and wide. In the last year, our team represented NASA at more than 100 events within NASA and across the space community. We established formal partnerships and engaged in informal discussions with academia, other government agencies, and commercial partners. We have inspired the next generation of space explorers through internships and university capstone projects.

I am honored to present the inaugural OTPS Annual Report, in which we share some of our proudest moments and biggest wins from our first year. As we look back, our excitement for what lies ahead only grows, and I can’t wait to see what the future brings.

I would like to thank Administrator Bill Nelson, Deputy Administrator Pam Melroy, and Associate Administrator Robert Cabana for their confidence in and support of our work. My deepest gratitude is reserved for the OTPS team for their tireless efforts to become a high-performing, mission-driven, and cohesive team that will inspire and inform future NASA decisions.

Bhavya Lal
Associate Administrator and Agency Chief Technologist (Acting)
NASA Office of Technology, Policy, and Strategy

MAKING AN IMPACT: BRINGING TOGETHER DIFFERENT CAPABILITIES TO FOCUS ON THE WHAT, THE WHY, AND THE HOW OF NASA

OTPS has brought together a diverse team of experts from within NASA, other federal agencies, and research organizations with a wide range of skills and capabilities. Our subject matter experts specialize in technology assessments, cost-benefit assessments, space policy, emerging markets, legal analyses, and international partnerships. We perform unbiased, non-advocacy research and analyses that informs key decision-makers in taking appropriate action.

In our first year, we helped NASA leadership untangle issues around in-space authorization and the supervision of novel activities. We addressed policy challenges related to Moon-to-Mars exploration, including those associated with the deconfliction of lunar operations. We cultivated innovative ways to build an international coalition, perform Artemis Accords outreach, and deliberate commercial norms of behavior. We advised leadership on challenges and ways forward related to space nuclear power and propulsion.

OTPS led NASA's support of White House initiatives related to the Cancer Moonshot, artificial intelligence, advanced manufacturing, and quantum science. We also supported colleagues around NASA on White House strategies related to in-space servicing, assembly, and manufacturing, and orbital debris mitigation and remediation.

In the following pages, we highlight the many ways OTPS works across NASA to help the agency achieve its mission.

COLLABORATING ACROSS NASA AS PART OF A BIGGER TEAM

In addition to supporting NASA leadership, OTPS and center-based chief technologists serve as a resource for NASA's mission directorates and centers. Working in partnership across NASA expands our point of view and enables us to understand the implications of what we propose. It also allows OTPS to share policy learnings with other parts of the agency that may not fully realize the role policy plays in our operations. Through a series of capacity-building initiatives, OTPS is working to increase policy practice and strengthen the workforce at NASA.

DEVELOPING CAPABILITIES IN-HOUSE AND OUTSIDE NASA

OTPS created a residency program so NASA employees could have the space to explore emerging or disruptive ideas away from their day jobs. The **Solver-in-Residence** will use analytic methods to tackle issues that will transform the future of NASA. This year, OTPS welcomed its first Solver-in-Residence, who will spend the next year focusing on a self-defined project to develop quantitative approaches to technology investment.

OTPS also welcomed its first **Policy Fellow**, who will support our work on policy implications for NASA's Moon to Mars objectives and other projects. The fellowship trains future NASA leaders to better understand, navigate, and inform the technology, policy, and strategy landscape where they work. The Fellow reciprocally provides OTPS with relevant technical subject matter expertise.

PROVIDING STUDENTS WITH REAL-WORLD, HANDS-ON EXPERIENCE

OTPS kicked off its University **Capstone Program** this year with three small, rural, or minority-serving institutions. OTPS team members provided project topics in technology, policy, and strategy and are mentoring students working on topics with technology and policy implications from the University of Texas at El Paso, Prairie View A&M, and John Carroll University.

Students picked from one of two projects related to climate and environmental science or early-stage technology. They could write a data-driven report on the implications of increased in-space activities on Earth's environment, or students could develop a framework for how large organizations such as NASA should decide between competing investments in multiple early-stage technologies.

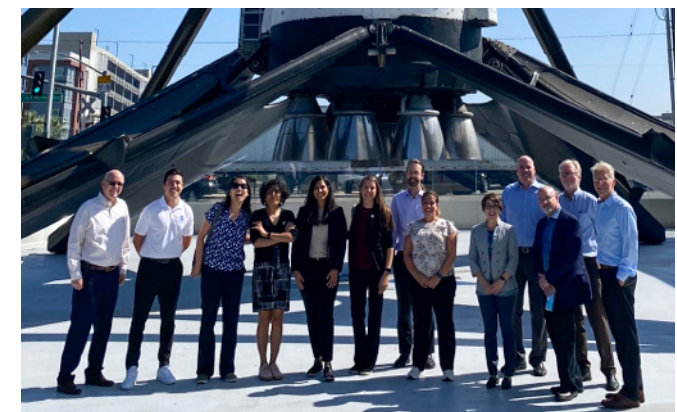
OTPS offers paid full- and part-time **internships** to undergraduate and graduate students to work on meaningful projects aligned with the OTPS focus areas. In its first year, OTPS welcomed seven interns who brought their valuable outside interests and expertise to the office. They have shared their knowledge and perspectives through formal and informal presentations. All interns have contributed to ongoing OTPS studies and led independent review projects on important, relevant topics, including wildfires, orbital debris mitigation, quantum sensing, and space settlement.

FLUENCY ACROSS THE AGENCY AROUND POLICY ISSUES

NASA's work affects and shapes a range of space policies internally and externally to NASA. In OTPS' first year, Associate Administrator Lal and our team members visited all 10 NASA centers. Lal and Gertsen routinely brief senior agency leaders on OTPS' vision, mission, and ongoing activities.

OTPS is building agencywide awareness of space policy issues and developing a cohort of learners and enthusiasts within NASA through an informal network. Together with our colleagues around NASA, OTPS created a forum called **the Informal Space Policy Network (ISPN)** that meets monthly to share priorities and ongoing work, address challenges, and exchange ideas about space policy issues. It's also a forum to discuss and learn about topics of interest through invited, topical presentations.

OTPS hosts its **Seminar Series** with disruptive, innovative thinkers to inspire and ignite the minds of OTPS staff, NASA leadership, and the broader NASA workforce. Guests have included world-renowned economists, technologists, innovation experts, and industry leaders such as Arati Prabhakar, Phillip Tetlock, Marianna Mazzucato, William Bonvillian, and Eric Schmidt, among others. Seminar topics spanned space policy and technology analysis, American innovation preservation, evolving government innovation and investments, changes to government industrial policy approaches, and more.



OTPS at SpaceX.

THE FACES OF OTPS



Alyse Beauchemin**



Patrick Besha



Trina Braxton*



Tom Colvin*



Ellen Gertsen



Elaine Gresham**



Laura Delgado Lopez*



Jason Hay**



Amanda Hernandez**



Shanee Hill



Amanda Hirsch**



Nikolai Joseph



John Karcz*



Ave Kludze



Renata Kommel**



Bhavya Lal



Katie McBrayer*



Amber McIntyre*



Gabe Merrill*

*Detailee
**Contractor

THE FACES OF OTPS



The OTPS Team celebrates the 2022 holiday season.



Ulcka Patel*



Zach Pirtle*



Maia Robakidze**



Erica Rodgers



Peter Schemmel*



Jordan Sotudeh**



Gabriel Swiney*



Emily Sylak-Glassman*



Debi Tomek*



Ken Wright



Grace Wusk

HELPING NASA SOLVE COMPLEX PROBLEMS

In its first year, OTPS focused on several areas of importance to NASA leadership.

1

FOCUS AREA
MOON TO MARS EXPLORATION



OTPS team members visit NASA's Kennedy Space Center.

In NASA's first-ever annual Administrator's Intent memorandum, Administrator Nelson declared Moon to Mars exploration as one of his overarching priorities. Some notable OTPS studies focused on NASA's Moon to Mars objectives over the past year include:

ARTEMIS SOCIETY AND ETHICS WORKSHOP

The 1958 Space Act states that "space activities should be devoted to peaceful purposes for the benefit of all humankind." Assessing how NASA's Moon to Mars campaign benefits "all humankind" is complex and raises ethical questions that NASA has not yet systematically addressed. OTPS has begun to examine this topic through a series of workshops.

The first workshop will convene global experts to begin discussing how NASA and its partners should operationally consider the long-term consequences of Artemis. Participants will reflect on lessons learned from past government-funded efforts to examine ethical and societal implications. Expert talks and research presentations will include topics such as the risks and benefits of commercial services and broader public-private partnerships.

CISLUNAR EXPLORATION OF ARCHITECTURES (CLEAR)

The CLEAR study looked at overlapping architecture needs and technologies that can increase the survivability and sustainability of future operations beyond geosynchronous orbit.

The study resulted in two products. The first is a descriptive framework for assessing resiliency and enabling technical capabilities in future space architectures. The second highlights cross-cutting objectives and potential areas that could benefit from coordination and/or collaboration between NASA and the United States Space Force.

LUNAR LANDING SITES AND OPERATIONS POLICY ANALYSIS

OTPS conducted a study to develop options that answer questions related to the upcoming Moon missions between now and 2026. With more than 20 domestic, international, and commercial lunar missions planned, humanity will face new challenges that arise.

Working collaboratively with and building on the technical expertise of NASA scientists and engineers, OTPS identified policy options that might address these challenges. Solutions that will allow NASA—and all humanity—to live, work, and collaborate on the Moon in a safe, sustainable, and predictable way.

POLICY ISSUES ASSOCIATED WITH THE MOON TO MARS OBJECTIVES

In September, NASA released 63 technical, operational, and scientific objectives for the agency as part of our campaign to explore the Moon and Mars. Some objectives involve establishing fixed, long-term facilities on the Moon and Mars. This action prompts questions of how to ensure safety and control over NASA facilities while allowing other actors freedom of access to those areas. In 2022, OTPS began a new project to identify policy issues that may develop and require attention when implementing the objectives. The report intends to provide options for how NASA, the U.S. government, and our commercial and international partners can potentially address them.

SUPPORTING THE DIRECTOR FOR SPACE ARCHITECTURES

OTPS collaborates with NASA's Director of Space Architectures, who chairs the Agency Cross-Directorate Federated Board, a NASA-internal leadership group working on the Moon to Mars strategy. In its first year, OTPS supported the Executive Secretariat of the Federated Board and piloted the development of a framework to analyze spaceflight architectures.

2

FOCUS AREA
SPACE SUSTAINABILITY



Deployment of the NanoRacks-Remove Debris Satellite from the International Space Station (ISS). Photographer: Drew Feustel

Maintaining our long-term ability to utilize space for science, exploration, national security, and commercial activities is the essence of space sustainability, playing a critical part for NASA as a global role model in space. OTPS conducts activities and projects focused on meeting the needs of the present space community while preserving the ability of future generations to meet theirs.

In 2022, we briefed NASA leadership on the structure and organization of the agency's sustainability-related organizations and proposed alternative models for improvement. We also responded to the NASA Administrator's questions on which federal agency should provide on-orbit authority for private sector activities in space, business cases for space-based commercial constellations, and policy concerns around commercial space traffic.

OTPS has had several accomplishments in space sustainability during our first year:

SYNTHESIS AND EVALUATION OF NASA CONCEPTS RELATED TO ORBITAL DEBRIS MITIGATION AND REMEDIATION

OTPS created a NASA-wide internal working group and coordinated inputs to develop solutions for orbital debris mitigation and remediation. As part of the evaluation process, we solicited feedback from industry and other government agencies on proposed NASA solutions.

COST-BENEFIT ANALYSIS (CBA) OF ACTIVE DEBRIS REMEDIATION (ADR)

OTPS is conducting an analysis of the costs and benefits related to Active Debris Remediation (ADR). The primary goal of this project is to inform the U.S. government’s long-term Orbital Debris Research and Development Strategy. When complete, the study will identify the most cost-efficient approaches to remediate orbital debris risks and prioritize promising ADR technologies.

COLLABORATIONS WITHIN NASA

OTPS partnered with the Space Technology Mission Directorate (STMD) on Active Debris Removal activities, including the review of Tipping Point proposals related to debris remediation. OTPS also contributed as a Topic Author for a Small Business Innovation Research Ignite proposal on the Commercial Development of Active Debris Remediation Services.

COLLABORATION WITH THE BROADER SPACE SUSTAINABILITY COMMUNITY

In our first year, we funded external research on the economic, social, and political elements of orbital debris and space sustainability through a call for NASA’s Research Opportunities in Space and Earth Sciences (ROSES)-2022. The research will inform a strategic NASA and/or United States government approach to orbital debris and international space sustainability efforts. We were also part of the NASA team that worked with the Office of Science and Technology Policy (OSTP) to develop an orbital debris implementation plan. Currently, we are collaborating with the Organization of Economic Co-operation and Development (OECD) in sustainability-related activities, including complementary international research projects, briefings, and publications.

3

FOCUS AREA
THE FUTURE OF NASA AND OTHER AD HOC ACTIVITIES

OTPS conducts projects to assess how the space sector considers the future. We examine trends across NASA, domestic and foreign government partners, and industry to help the agency operate effectively and strategically for decades to come.

OTPS is proud to share some of the impactful ways we helped NASA prepare and plan for the future this past year:

EXPLORING THE FUTURE OF THE SPACE SECTOR

The Aerospace Safety Advisory Panel recommended that NASA develop a strategic vision for the future of space exploration and operations. In collaboration with Aerospace Corporation’s strategic foresight team, OTPS conducted eight futures roundtables with more than 200 internal and external agency participants to develop a report on potential scenarios for 2040 and beyond. The report also investigates strategic options resilient to these scenarios and key questions NASA may consider when developing strategic plans today.



Aft view of the International Space Station.

A REVIEW OF OPTIONS FOR A NATIONAL LAB FOR MICROGRAVITY/ ORBITAL ACTIVITIES IN LEO

NASA is preparing to retire the International Space Station (ISS) and transition low-Earth orbit (LEO) activities to one or more Commercial LEO Destinations (CLDs) by 2030. This study helps NASA’s Space Operations Mission Directorate elucidate NASA’s options for facilitating government-funded activities in the post-ISS LEO ecosystem. It provides potential models for an ISS National Lab facilitating government-funded or subsidized activities on a commercial LEO platform. The study also suggests modifications to the current model that ensures a smooth transition.

EVALUATING PROSPECTS FOR SPACE-BASED SOLAR POWER

Space-based solar power (SBSP) is the concept of gathering power in space and transmitting the power wirelessly to users on Earth or elsewhere in space. Advocates of SBSP note that it promises 24/7 energy generation capability with minimal pollution. Detractors believe the benefits of SBSP are exaggerated and will exceed costs. Other government agencies, such as the U.S. Department of Defense, the European Space Agency, and the Japan Aerospace Exploration Agency, have recently shown a resurgence of interest centered around SBSP to minimize greenhouse gas emissions associated with grid-level power generation. This study assesses the costs and benefits of SBSP in attaining net zero emissions. The study also evaluates the degree to which NASA should support the development of SBSP if the benefits exceed costs.

SUPPORTING NASA’s SPACE SECURITY INTERESTS

OTPS provides subject matter expertise, insights, and analysis on geopolitical issues that helps NASA leadership evaluate global space programs and strategies related to our exploration goals. Examples include deep-dive analysis of strategic competitors and risk assessments of International Space Station partners. In 2022, we supported our NASA and White House colleagues in the development of new initiatives that promote the peaceful use of outer space, like the International Lunar Year.

APPENDICES

What a year for NASA’s Office of Technology, Policy, and Strategy! In our first year, **we led almost 40 projects and spoke at 100 events and conferences.** From keynote speeches and panel discussions to poster presentations and session chairs, OTPS team members represented NASA across the globe.

A INVENTORY OF OTPS STUDIES, PROJECTS, ACTIVITIES, AND INITIATIVES

Title: A HOLISTIC ASSESSMENT OF NASA’S SPACE INDUSTRIAL BASE/ SUPPLY CHAIN REQUIREMENTS AND CAPABILITIES
Project Lead: Ave Kludze
Status: In progress
Summary: This agencywide survey will assist in the identification and documentation of the current and emerging Industrial Base/Supply Chain related activities, challenges, gaps, and risks that NASA must consider. The study will also develop comprehensive recommendations to satisfy the agency’s future needs and requirements.

Title: A REVIEW OF OPTIONS FOR A NATIONAL LAB FOR MICROGRAVITY/ORBITAL ACTIVITIES IN LEO
Project Lead: Erica Rodgers
Status: Complete
Summary: NASA is preparing to retire the International Space Station (ISS) and transition low-Earth orbit (LEO) activities to one or more Commercial LEO Destinations



the International Space Station

The study also suggests modifications to the current model that ensures a smooth transition.

(CLDs) by 2030. This study helps NASA’s Space Operations Mission Directorate elucidate NASA’s options for facilitating government-funded activities in the post-ISS LEO eco-system. It provides potential models for an ISS National Lab facilitating government-funded or subsidized ac-tivities on a commercial LEO platform.

Title: ARTEMIS SOCIETY AND ETHICS WORKSHOP
Project Lead: Zach Pirtle
Status: In progress
Summary: The 1958 Space Act states that “space activities should be devoted to peaceful purposes for the benefit of all humankind.” Assessing how NASA’s Moon to Mars campaign benefits “all humankind” is complex and raises ethical questions that NASA has not yet systematically addressed. OTPS has begun to examine this topic through a series of workshops.

The first workshop will convene global experts to begin discussing how NASA and its partners should operationally consider the long-term consequences of Artemis. Participants will reflect on lessons learned from past govern-ment-funded efforts to examine ethical and societal implications. Expert talks and research presentations will include topics such as the risks and benefits of commercial services and broader public-private partnerships.

Title: ARTICULATE THE POTENTIAL BENEFITS OF THE ARTEMIS PROGRAM FOR A BROADER AUDIENCE
Project Lead: Patrick Beshu
Status: Complete
Summary: The economic and national competitiveness benefits of the Artemis program complement its inherent values of scientific discovery, technology development, space exploration, and global leadership. This paper examines how the Artemis program benefits the U.S. economy by driving innovation and new capabilities. It explores lowering the cost of access to space, improving market competition, expanding the customer base, and how the Artemis program can help U.S. firms compete in the global marketplace.



Title: CISLUNAR EXPLORATION OF ARCHITECTURES (CLEAR)
Project Lead: Erica Rodgers
Status: Complete
Summary: The CLEAR study looked at overlapping architecture needs and technolo-gies that can increase the survivability and sustainability of future operations beyond geosynchronous orbit.

The study resulted in two products. The first is a descriptive framework for assessing resiliency and enabling technical capabilities in future space archi-tectures. The second highlights cross-cutting objectives and potential areas that could benefit from coordination and/or collaboration between NASA and the United States Space Force.

Title: CO2 EMISSIONS FROM LAUNCH OF A NUCLEAR REACTOR VS A SOLAR POWER SYSTEM (CO2)
Project Lead:
Status: Erica Rodgers
Summary: Complete
The purpose of this study was to compare carbon dioxide (CO2) launch emissions between nuclear power and solar power systems on the surface of the Moon. System mass is the key parameter assessed for a nominal hydrocarbon-fueled rocket launch. Launching a more massive surface power system will result in higher CO2 launch emissions. The mass difference between solar and fission power generation systems depends on the types of technologies used and the architectural design.

Title: COST-BENEFIT ANALYSIS (CBA) OF ACTIVE DEBRIS REMEDIATION (ADR)
Project Lead: Tom Colvin
Status: In progress
Summary: OTPS is conducting an analysis of the costs and benefits related to Active Debris Remediation (ADR). The primary goal of this project is to inform the U.S. government’s long-term Orbital Debris Research and Development Strategy. The study will identify the most cost-efficient approaches to remediate the risks due to orbital debris and prioritize promising ADR technologies.

Title: DISCUSSION ON SPACE SUSTAINABILITY
Project Lead: Patrick Besha
Status: Complete
Summary: NASA prepared a briefing and memo outlining the agency’s historical and prospective role in orbital debris and space sustainability.

Title: ECONOMIC AND POLICY ANALYSES OF SPACE SUSTAINABILITY
Project Lead: Patrick Besha
Status: In progress
Summary: OTPS works closely with the Organization for Economic Cooperation and Development based in Paris to develop research on the economics of space sustainability. OTPS recently supported and guided the development of a new publication, “Earth’s Orbits at Risk: The Economics of Space Sustainability.”

Title: EVALUATING PROSPECTS FOR SPACE-BASED SOLAR POWER
Project Lead: Nikolai Joseph
Status: In progress
Summary: Space-based solar power (SBSP) is the concept of gathering power in space and transmitting the power wirelessly to users on Earth or elsewhere in space. Advocates of SBSP note that it promises 24/7 energy generation capability with minimal pollution. Detractors believe the benefits of SBSP are exaggerated and will exceed costs. Other government agencies, such as the U.S. Department of Defense, the European Space Agency, and the Japan Aerospace Exploration Agency, have recently shown a resurgence of interest centered around SBSP to minimize greenhouse gas emissions associated with grid-level power generation. This study assesses the costs and benefits of SBSP in attaining net zero emissions. The study also evaluates the degree to which NASA should support the development of SBSP if the benefits exceed costs.

Title: EXPLORING THE FUTURE OF THE SPACE SECTOR
Project Lead: Kenneth Wright
Status: Complete
Summary: The Aerospace Safety Advisory Panel recommended that NASA develop a strategic vision for the future of space exploration and operations. In collaboration with Aerospace Corporation’s strategic foresight team, OTPS conducted eight futures roundtables with more than two hundred internal and external agency participants to develop a report on potential scenarios for 2040 and beyond. The report also investigates strategic options resilient to these scenarios and key questions NASA may consider when developing strategic plans today.



SpaceX rocket launch

Title: HISTORY OF THE MOON TREATY
Project Lead: Patrick Besha
Status: In progress
Summary: With financial support and oversight from OTPS, the NASA History Office and the Associate Administrator of Space Security Interests are developing a publication covering the history of the U.S. government and NASA’s involvement with the development of the Moon Treaty. The project builds upon previous research related to the Outer Space Treaty and the overall international framework for space activities.

Title: IAF SPACE ECONOMY COMMITTEE
Project Lead: Bhavya Lal
Status: In progress
Summary: The OTPS team is co-leading the International Astronautical Federation Space Economy Committee. By chairing International Astronautical Congress sessions in cooperation with other interested committees and member organizations, this committee is building a more complete and nuanced understanding of the economics of space activities.

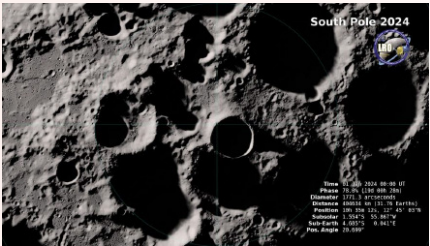
Title: INDEPENDENT ECONOMIC AND POLICY ANALYSES OF SPACE SUSTAINABILITY
Project Lead: Patrick Besha
Status: In progress
Summary: As part of NASA’s efforts to address orbital debris, the agency is funding research proposals from three university-based teams over the next year. The teams will analyze the economic, social, and policy issues associated with space sustainability. OTPS will publish the results on the agency’s website. Teams will also have the chance to work with the International Organization for Economic Cooperation and Development as part of an international call for research proposals on orbital debris and space sustainability.

Title: INNOVATION PORTAL
Project Lead: Ken Wright
Status: Complete
Summary: The Innovation Portal connects all NASA civil servants and contractors to products, people, projects, and tools from around the agency. The portal's search capability allows users to investigate topic areas and view high-level results from various NASA-internal websites. The user can select a record from the search results to see a more detailed view or link to the authoritative source for additional information. Users may also view results in a node view that graphically shows search results.

Title: ISAM NASA ENDSTATES
Project Lead: Debi Tomek
Status: In progress
Summary: An OTPS-led cross-agency team developed the “Space Superhighway” mission concept and addressed NASA’s role in its development. The team developed roadmaps for each concept identifying technology development prioritization, as well as legal, regulatory, and policy barriers. The concepts also identify a public-private partnership approach to execute the concepts, enabling technology transfer, commercial collaboration, and an infrastructure-as-a-service model.

Title: ISAM NATIONAL IMPLEMENTATION PLAN AND NASA ISAM STRATEGY
Project Lead: Debi Tomek, Trudy Kortez, Alvin Drew
Status: In progress
Summary: OTPS supported the development of a White House led In-Space Servicing, Assembly, and Manufacturing (ISAM) Strategy and Implementation Plan. In collaboration with colleagues around NASA, OTPS also facilitated a coordinated and collective effort by civil and defense space, along with commercial partners, to accelerate the development and deployment of ISAM capabilities.

Title: LUNAR LANDING SITES AND OPERATIONS POLICY ANALYSIS
Project Lead: Gabriel Swiney
Status: Complete
Summary: OTPS conducted a study to develop options that answer questions related to the upcoming Moon missions between now and 2026. With more than



Lunar Surface image credit: NASA's Scientific Visualization Studio)

Solutions that will allow NASA—and all humanity—to live, work, and collaborate on the Moon in a safe, sustainable, and predictable way.

20 domestic, international, and commercial lunar missions planned, humanity will face new challenges that arise.

Working collaboratively with and building on the technical expertise of NASA scientists and engineers, OTPS considered policy solutions that might address these challenges.

Title: MOON TO MARS (M2M): ARCHITECTURE LANDSCAPE SENSITIVITY TOOL, PHASE 1
Project Lead: Tom Colvin
Status: In progress
Summary: This project aims to develop an analytical tool that captures the connections and relative sensitivities of all the factors influencing Moon to Mars architecture, with two primary use cases. It will provide decision-makers with a lens to explore the sensitivity between factors. It will also illustrate the degree to which certain studies and technology development efforts have considered the broader landscape and what assumptions were made.



Mars

The study was designed to work in three phases, each with its own goals and objectives. The study will measure whether NASA's current scouting capability meets best practice standards from industry, academia, and other government agencies.

Title: MOON TO MARS (M2M): FEDERATED BOARD (FB) EXECUTIVE SECRETARIAT SUPPORT
Project Lead: Raymond Gabriel Merrill, Laura Delgado Lopez
Status: Ongoing
Summary: This project supported the Federated Board’s regular business. It also refined the Moon to Mars objectives through a process that included an architecture gap analysis and input solicitation through internal and external comments and workshops. Deputy Administrator Melroy publicly rolled out the updated objectives at the 2022 International Aeronautical Congress.

Title: NASA-DOC CIVIL SPACE INDUSTRIAL BASE AND SUPPLY CHAIN SURVEY
Project Lead: Patrick Beshu
Status: In progress
Summary: NASA OTPS seeks visibility into the current and prospective performance of the civil space industrial base and supply chain. We aim to understand potential gaps and weaknesses in our supply chain to mitigate and avoid severe impacts on our programs and missions. The NASA-DOC survey will assess factors like the supply chain impacts resulting from the COVID-19 pandemic, mergers and acquisition trends, and other areas of interest.

Title(s): OTHER GOVERNMENT AGENCY (OGA) EVALUATION OF ORBITAL DEBRIS REVIEW TEAM PROPOSALS AND INDUSTRY EVALUATION OF ORBITAL DEBRIS REVIEW TEAM PROPOSALS
Project Lead: Patrick Beshu
Status: In progress
Summary: In 2021, NASA established the Orbital Debris Review Team (ORDT), an internal working group tasked with identifying challenges and solutions to addressing orbital debris and advancing space sustainability. OTPS conducted outreach with interagency and industry partners for feedback on ODRT’s work that identified shared priorities and opportunities for potential collaboration with others.

Title: PLANETARY DEFENSE STRATEGY

Project Lead: Patrick Besha

Status: In progress

Summary: Planetary defense encompasses the necessary capabilities to detect, warn, prevent, and mitigate the effects of a potential asteroid or comet collision with Earth. OTPS is co-leading a Planetary Defense Strategy Working Group (PDSWG) with the Planetary Defense Coordination Office (PDCO) that articulates activities for NASA to continue making tangible progress in planetary defense. The goal is to develop an agency strategy demonstrating national and global leadership in this area. OTPS is also supporting an update of the White House strategy and action plan on planetary defense.

Title: POLICY ANALYSIS – CIVIL AGENCY TASKED WITH ON-ORBIT AUTHORITY

Project Lead: Patrick Besha

Status: Complete

Summary: OTPS led the development of a leadership memo articulating which U.S. government (USG) regulatory agency to task with exercising on-orbit authority (OOA) over U.S.-origin space activities. To formulate our assessment, OTPS reviewed the literature and conducted informal discussions with 27 individuals across NASA, other government agencies, industry, universities, non-governmental organizations, and independent experts.

Title: POLICY ISSUES ASSOCIATED WITH THE MOON TO MARS OBJECTIVES

Project Lead: Gabriel Swiney

Status: In progress

Summary: In September, NASA released 63 technical, operational, and scientific objectives for the agency as part of our campaign to explore the Moon and Mars. Some objectives involve establishing fixed, long-term facilities on the Moon and Mars. This action prompts questions of how to ensure safety and control over NASA facilities while allowing other actors freedom of access to those areas. In 2022, we began a new project to identify policy issues that may develop and require attention when implementing the objectives. The report intends to provide options for how NASA, the U.S. government, and our commercial and international partners can potentially address them.

Title: SATELLITE INTERNET MEGACONSTELLATIONS

Project Lead: Emily Sylak-Glassman

Status: Complete

Summary: At the Administrator’s request, OTPS presented NASA leadership with the most current information and analysis about future operations where thousands of small satellites provide internet.

Title: SUPPORT AN EXTERNAL REVIEW OF THE MARS TRANSPORTATION ASSESSMENT STUDY (MTAS)

Project Lead: Nikolai Joseph

Status: In progress

Summary: OTPS lead a review of the Mars Transportation Assessment Study (MTAS) by external experts. The review assessed the claims made in the report and questioned the assumptions and process to see if the conclusions were reasonable and valid. The authors received feedback, then updated and improved the report. The evaluation helped clarify the assumptions and improve transparency of the findings of the report.

Title: SUPPORTING NASA's SPACE SECURITY INTERESTS

Project Lead: Patrick Besha

Status: Ongoing

Summary: OTPS provides subject matter expertise, insights, and analysis on geopolitical issues that help NASA leadership evaluate global space programs and strategies related to our exploration goals. Examples include deep-dive analyses of strategic competitors and risk assessments of International Space Station partners. We also supported our NASA and White House colleagues in the development of new initiatives that promote the peaceful use of outer space, like the International Lunar Year.

Title: TECHNOLOGY SCOUTING STUDY

Project Lead: Ellen Gertsen/Peter Hughes, Chief Technologist, Goddard Space Flight Center

Status: In progress

Summary: Identifying emerging technologies is critical to a mission-oriented agency such as NASA that endeavors to achieve first-of-a-kind human and scientific exploration goals. Technology scouting provides a mechanism for maintaining awareness of externally developed technologies that could be applicable. The



OTPS at Cal Tech.

overall goal of the Technology Scouting project is to develop an approach to conduct effective technology scouting within NASA. The study will measure current capabilities, assess the appetite for more, propose candidates for a scouting pilot program, and develop an implementation approach.

Title: TECHNOLOGY TAXONOMY

Project Lead: Dave Voracek, Chief Technologist, Armstrong Flight Research Center

Status: Ongoing

Summary: The current NASA Taxonomy was developed in 2020. It provides a structure for articulating the technology development disciplines needed to enable future space missions and support commercial air travel. OTPS is developing a means to update and maintain the taxonomy as disciplines and technology needs change through a Configuration Control Process. The process is in a testing phase in FY23 and should be ready to implement in FY24 for future changes.

Title: WHITE PAPER AND BRIEFING ON IN-SPACE MANUFACTURING

Project Lead: Kenneth Wright

Status: Complete

Summary: This project produced a white paper and briefing deck on In-Space Manufacturing used to inform the National Economic Council. The report included details of investments by NASA and its partners as well as the potential economic market catalyzed by NASA's investments in the area. It provided information on the advantages of products of in-space manufacturing for use on earth and in space. In addition, it offered insight into the recent growth in commercial markets and highlighted technical challenges associated with in-space manufacturing from a global perspective.

B

OTPS INTERN PROJECTS

- Title:

CLIMATE OBSERVATION ON PERSISTENT PLATFORMS
- Project Lead:

Naylah Canty, Massachusetts Institute of Technology
- Status:

Complete
- Summary:

Earth observation from space enables the collection of large amounts of geo-spatial data on our cities, seas, trade routes, ecosystems, and environment. It aids the development of climate models and our understanding of climate change. The reliability and accuracy of these climate analyses benefit from consistent, persisting data and climate observation from Earth-observation spacecraft. Persistent platforms, which are in-space assets, could extend the collection of climate science data and allow observation technologies to evolve without large, repeated, costly launches. This paper details how the longevity and modular nature of persistent platforms support climate observation.
- Title:

FUTURE OF ADDITIVE MANUFACTURING IN SPACE
- Project Lead:

Abigail Fearnelyhough, University of Wyoming
- Status:

Complete
- Summary:

Additive manufacturing can help reduce the number of products included in payloads from Earth to their destination. It allows astronauts in space to recycle and use plastics to make small, needed tools. In the future, additive manufacturing could aid in building planetary habitation structures, spacecraft, and even food sources in space. This project addresses the potential capabilities additive manufacturing in space can enable and assesses what the field looks like now. It also examines what in-space, for-space additive manufacturing could look like in the next 10 to 20 years.
- Title:

NASA & WILDFIRES
- Project Lead:

Rydell Stottlemeyer, University of Colorado Boulder
- Status:

Complete
- Summary:

NASA is in a unique position to fight against the growing threat of wildfires across much of the United States. Satellite-based fire detection, novel aviation techniques, and fire-resistant materials are all examples of technological overlap between NASA and fire agencies like the U.S. Forest Service (USFS). This project identified areas NASA is or could be involved with in helping the nation combat the increasing threat of wildfires and to identify barriers to collaboration.

- Title:

REVIVING THE SPACE SETTLEMENT ACT
- Project Lead:

Omar Pimentel, Stanford University
- Status:

In progress
- Summary:

The Space Settlement Act (SSA) of 1988 intended to amend the National Aeronautics and Space Act of 1958 that established NASA. The congressional declaration stated that extending human life into extraterrestrial space to advance science, exploration, and development would enhance the general welfare of Earth. The SSA said that space settlements, or human communities with substantial independence from Earth, would further accomplish scientific purposes. This project examines NASA's previously codified responsibility to submit a Sec217(c) report regarding the SSA to the President and Congress every other year. Our goal is to understand what happened to this policy and what implications its reinstatement could bring.
- Title:

SPACE LICENSING REGULATION FOR COMMERCIAL ACTORS AS IT RELATES TO SUSTAINABILITY
- Project Lead:

Perri Thaler, Cornell University
- Status:

Complete
- Summary:

As more public and private entities participate in space activities, the effort toward sustainability becomes more pressing. Each added object in space needs protection, yields a more densely populated environment, and introduces risk. This study compared the domestic structure of space licensing to that of a country with more recent regulations and considerations for sustainability. The study described and evaluated both governance structures, noting similarities and differences in efficacy and impact. It also reflected on necessary future U.S. policy work in this area.
- Title:

TECHNOLOGY SCOUTING
- Project Lead:

Stephanie Silva Lopez, University of Puerto Rico at Mayagüez
- Status:

Complete
- Summary:

In support of the Technology Scouting study, Stephanie's project focused on researching different methods of tech scouting to improve NASA's current approach. Her phase one work validated if NASA's current tech scouting capabilities are consistent with other government agencies, industry, and academia. This validation was done by conducting weeks of literature review and team meetings, followed by weeks of interviews with NASA centers, government agencies, and private companies.
- Title:

THE FUTURE OF QUANTUM SENSING AT NASA
- Project Lead:

Holland Frieling, University of Texas at Austin
- Status:

Complete
- Summary:

Quantum science has the potential to make technologies faster, more efficient, and more precise. Its three applications of quantum sensing, quantum communication, and quantum computing take advantage of fundamental quantum mechanical principles to make new devices. This project focused on NASA's relationship with quantum sensing and the policies NASA should implement to research and develop quantum sensing technologies effectively.

C
OTPS PARTICIPATION IN EVENTS
AND CONFERENCES

NOVEMBER 2021

Event: **AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS (AIAA) ASCEND**
Role: Bhavya Lal, Panelist
Panel(s): **Aligning Government Demand and Commercial Supply to Advance U.S. Leadership in Space**
Nuclear Energy and Space in the Near Future: Opportunity and Reasons for Optimism
Space Policy

Event: **COLUMBIA UNIVERSITY**
Role: Bhavya Lal, Speaker
Topic: **Roles of Industry and Government in Space**

Event: **GEORGETOWN UNIVERSITY**
Role: Bhavya Lal, Speaker
Topic: **Review of Space Policy Issues**

DECEMBER 2021

Event: **EUROPEAN SPACE AGENCY WORKSHOP**
Role: Bhavya Lal, Panelist
Topic: **Cost-Benefit Analysis of Space-Based Solar Power**

Event: **GEORGETOWN UNIVERSITY PODCAST**
Role: Bhavya Lal, Guest
Topic: **Space Technology, Policy, and Strategy at NASA**

Event: **NASA ADVISORY COMMITTEE ON TECHNOLOGY, INNOVATION AND ENGINEERING (TI&E)**
Role: Bhavya Lal, Speaker
Topic: **An Overview of Technology, Policy, and Strategy at NASA**

Event: **SPACE TO GROW PODCAST**
Role: Bhavya Lal, Guest
Topic: **Challenges to Space Sustainability and the Role of NASA**

JANUARY 2022

Event: **DOD INNOVATION GOLDEN BEAR 3 INITIATIVE**
Role: Bhavya Lal, Speaker
Topic: **Innovation and Technology at NASA**

Event: **COMPTIA SPACE ENTERPRISE COUNCIL**
Role: Bhavya Lal, Speaker
Topic: **An Overview of Technology, Policy, and Strategy at NASA**

Event: **SYRACUSE UNIVERSITY**
Role: Bhavya Lal, Speaker
Topic: **Technology Strategy Choices at Federal Agencies**

FEBRUARY 2022

Event: **ASSOCIATION OF AMERICAN UNIVERSITIES (AAU) INNOVATION TASK FORCE**
Role: Bhavya Lal, Speaker
Topic: **An Overview of Technology, Policy, and Strategy at NASA**

Event: **AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS (AIAA) POLICY WEBINAR**
Role: Bhavya Lal, Speaker
Topic: **An Overview of Technology, Policy, and Strategy at NASA**

Event: **GEORGE WASHINGTON UNIVERSITY SPACE POLICY INSTITUTE**
Role: Bhavya Lal, Speaker
Topic: **National Power Case for the Artemis Program**
Role: Gabriel Swiney, Speaker
Topic: **Space Law**

Event: **HUMAN RESEARCH PROGRAM INVESTIGATORS WORKSHOP**
Role: Grace Wusk, Judge
Topic: **Graduate Student and Postdoctoral Fellow Poster Competition**

Event: **MITRE CORPORATION AND THE ASPEN INSTITUTE SECURING SPACE: THE SECURITY AND RESILIENCY OF SPACE SYSTEMS**
Role: Bhavya Lal, Keynote
Topic: **Role of NASA in Space Security and Resiliency**
Role: Erica Rodgers, Roundtable Discussion
Topic: **Identifying Key Challenges to Space Systems Security and Resiliency, and How to Overcome Them**

Event: **2022 COMMERCIAL SPACE TRANSPORTATION CONFERENCE**
Role: Bhavya Lal, Panel Moderator
Topic: **How Commercial Space is Enabling the Exploration of the Cosmos**

MARCH 2022

Event: **GEORGE WASHINGTON UNIVERSITY**
Role: Bhavya Lal, Panelist
Topic: **International Science and Technology Policy Panel**

Event: **NATIONAL DEFENSE UNIVERSITY’s SPACE INNOVATION PANEL**
Role: Erica Rodgers, Panelist
Topic: **Emerging Trends in Space Industry**

Event: **ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD) SPRING MEETING**
Role: Patrick Besha, Speaker
Topic: **Orbital Debris and Space Sustainability**

Event: **WOMEN LEADING IN OUTER SPACE**
Role: Bhavya Lal, Speaker
Topic: **Technology, Policy, and Strategy in the US Space Sector**

APRIL 2022

Event: **AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS (AIAA) ASCEND TEXAS**
Role: Bhavya Lal, Speaker
Topic: **Commercial Partnerships**

Event: **CISLUNAR FORESIGHTING WORKSHOP**
Role: Erica Rodgers, Speaker
Topic: **Government-Industry-Academia Space Enterprise for an Immersive Journey Exploring Potential Outcomes for the Emerging Cislunar Ecosystem**

Event: **INSTITUTE FOR DEFENSE ANALYSES NORMS OF BEHAVIOR**
Role: Bhavya Lal, Speaker
Topic: **Norms of Behavior in Civil Space**

Event: **NATIONAL SPACE SYMPOSIUM**
Role: Bhavya Lal, Moderator
Topic: **Space Technology**

Event: **NATIONAL SPACE SYMPOSIUM NORMS OF BEHAVIOR: A CROSS SECTIONAL LOOK**
Role: Bhavya Lal, Moderator
Topic: **Norms of Space Law, National Security, and Civil Space**

Event: **NAVAL POSTGRADUATE SCHOOL STUDENTS**
Role: Gabriel Swiney, Speaker
Topic: **NASA's Relationships with the National Security and International Communities**

Event: **SPACE GENERATION FUSION FORUM**
Role: Bhavya Lal, Speaker
Topic: **Space Policy, Career Path, Effective Communication**

MAY 2022

Event: **CALIFORNIA POLYTECHNIC STATE UNIVERSITY INTER-PLANETARY SMALL SATELLITE CONFERENCE**
Role: Bhavya Lal, Keynote Speaker
Topic: **Emerging Trends in Space**

Event: **HUMANS TO MARS SUMMIT**
Role: Bhavya Lal, Moderator
Topic: **Chemical vs Nuclear Propulsion**

Event: **INTERNATIONAL SPACE DEVELOPMENT CONFERENCE**
Role: Nikolai Joseph, Speaker
Topic: **Cost-Benefit Analysis of Space-Based Solar Power**

Event: **MITRE CORPORATION AND THE ASPEN INSTITUTE SECURING SPACE: THE SECURITY AND RESILIENCY OF SPACE SYSTEMS**
Role: Erica Rodgers, Speaker
Topic: **Strengthening Space Systems Security and Resilience**

Event: **NASA ASIAN AMERICAN AND PACIFIC ISLANDER (AAPI) HERITAGE MONTH**
Role: Bhavya Lal, Panelist
Topic: **Diversity at NASA and the Role of AAPI members**

Event: **NUCLEAR AND EMERGING TECHNOLOGIES FOR SPACE (NETS) CONFERENCE**
Role: Bhavya Lal, Keynote Speaker
Topic: **Moving Forward on Space Nuclear Power and Propulsion**

Event: **SPACE RESOURCES WEEK (LUXEMBOURG)**
Role: Gabriel Swiney, Speaker
Topic: **Policy Issues and NASA's Role in In-Situ Resource Utilization**

Event: **WHITE HOUSE FELLOWS PROGRAM**
Role: Ellen Gertsen, Speaker
Topic: **An Overview of Technology, Policy, and Strategy at NASA**

JUNE 2022

- Event: **4TH SUMMIT FOR SPACE SUSTAINABILITY IN LONDON**

Role: Laura Delgado Lopez, Panelist

Topic: **Government and Safety in Cislunar Space**
- Role: Patrick Besha, Speaker

Topic: **Orbital Debris and Space Sustainability**
- Event: **ANNUAL CONFERENCE OF THE COMMERCIAL SPACEFLIGHT FEDERATION**

Role: Bhavya Lal, Speaker

Topic: **Going Nuclear – Prospects for Power and Propulsion in Space**
- Event: **FUTURE IN-SPACE OPERATIONS (FISO) TELECOM SEMINAR PRESENTATIONS**

Role: Erica Rodgers, Speaker

Topic: **NASA Strategy for Technology Development**
- Event: **STATE OF THE SPACE INDUSTRIAL BASE CONFERENCE
SUSTAINABILITY AND PROSPERITY: WINNING THE SPACE RACE CONFERENCE**

Role: Bhavya Lal, Speaker

Topic: **Going Nuclear - Prospects for Power and Propulsion in Space**

JULY 2022

- Event: **BEYOND EARTH INSTITUTE**

Role: Bhavya Lal, Speaker

Topic: **Artemis Base Camp and NASA's Long-Term Plans on the Moon**
- Event: **BROOKE OWENS FELLOWSHIP ANNUAL SUMMIT**

Role: Bhavya Lal, Panelist

Topic: **Career Path for Women in Space**
- Role: Bhavya Lal, Fireside Chat Speaker

Topic: Career Lessons
- Role: Laura Delgado Lopez, Panelist, Mentor

Topic: **Career Path and Mentor Round Robin**
- Event: **CARNEGIE MELON**

Role: OTPS Team Visit

Topic: **How NASA Can Better Support Academic and Small Business Stakeholders**
- Event: **IMPERIAL COLLEGE INTERNATIONAL MOON DAY**

Role: Bhavya Lal, Panelist

Topic: **The Artemis Program and Accords**
- Event: **JOHN GLENN MEMORIAL SYMPOSIUM
AT CASE WESTERN RESERVE UNIVERSITY**

Role: Deborah Tomek

Topic: **Space Sustainability: The Future of ISAM**

- Event: **ZED FACTOR FELLOWSHIP SPEED MENTORING EVENT**

Role: Laura Delgado Lopez, Mentor

Topic: **Offering 2022 Fellows Insights and Professional Development Advice**

AUGUST 2022

- Event: **ARTEMIS I MISSION PRESS BRIEFING (FLORIDA)**

Role: Bhavya Lal, Panelist

Topic: **Preview of Artemis I Lunar Mission**
- Event: **NASA ARTEMIS 1 OVERVIEW MEDIA BRIEFING (WASHINGTON D.C.)**

Role: Bhavya Lal, Panelist

Topic: **Science Payloads on Artemis I**
- Event: **NASA LANGLEY LEGACY FELLOWSHIP ROUNDTABLE**

Role: Grace Wusk, Panelist

Topic: **Engaging the Innovative Mindset - Creativity and Community in the Workplace**
- Event: **THE ROAD TO ARTEMIS PRESS PANEL
(ORGANIZED BY ARIZONA STATE UNIVERSITY)**

Role: Bhavya Lal, Panelist

Topic: **NASA's Moon to Mars Exploration Plans and the Artemis Program**
- Event: **USSF UNIVERSITY CONSORTIUM SYMPOSIUM (COLORADO SPRINGS, CO)**

Role: Grace Wusk, Speaker

Topic: **NASA Engagements with Universities**



Bhavya Lal speaks at the 73rd International Aeronautical Congress.

SEPTEMBER 2022

- Event: **73RD INTERNATIONAL AERONAUTICAL CONGRESS (IAC)**

Role: Bhavya Lal, Plenary Panelist

Topic: **Defending the Earth: The International Effort to Protect Us from Asteroids and Comets**
- Role: Patrick Besha, Speaker

Topic: **Economic and National Competitiveness of Artemis**
- Role: Gabriel Swiney, Moderator

Topic: **Panel on Legal and Policy Issues in Moon and Mars Exploration**
- Role: Nikolai Joseph, Speaker

Topic: **Methodology of Cost-Benefit Analysis of SBSP**

Event: **AMOS EMER-GEN CAREER DEVELOPMENT PROGRAM**
Role: Bhavya Lal, Speaker
Topic: **Artemis Surface Activities**

Event: **THE NATIONAL GEM CONSORTIUM FELLOWSHIP NATIONAL CONFERENCE**
Role: Kenneth Wright, Panelist
Topic: **The Future of the Aerospace Industry**

Event: **INTERNATIONAL SPACE EXPLORATION COORDINATION GROUP (ISECG) ANNUAL MEETING**
Role: Nikolai Joseph, Speaker
Topic: **Various Analysis Products**

Event: **NASA MISSION EQUITY ROLLOUT**
Role: Bhavya Lal, Opening Keynote
Topic: **Diversity, Equity, Inclusion and Accessibility (DEIA) at NASA**

Event: **NASA QUANTUM SENSING WORKSHOP**
Role: Bhavya Lal, Speaker
Topic: **Essential Elements of a Strategy on Quantum Sensing**

Event: **TAPIA CONFERENCE**
Role: Kenneth Wright, Panelist
Topic: **Government Technology Priorities & Innovations: Digital Ecosystems**

Event: **THUNDERBIRD ARIZONA STATE UNIVERSITY EXECUTIVE MASTERS IN SPACE LEADERSHIP**
Role: Bhavya Lal, Speaker
Topic: **Challenges to and Ways Forward in Nuclear Propulsion**

Event: **UN/IAF'S 29TH WORKSHOP ON SPACE TECHNOLOGY FOR SOCIO ECONOMIC BENEFITS**
Role: Nikolai Joseph, Speaker
Topic: **Access to Space for All: Bridging the Space Divide**

Event: **WORLD ECONOMIC FORUM**
Role: Patrick Besha, Speaker
Topic: **Orbital Debris and Space Sustainability**

OCTOBER 2022

Event: 19TH ANNUAL SPACE MISSION PLANNING ADVISORY GROUP (SMPAG)
Role: Bhavya Lal, Opening Remarks
Topic: Global Cooperation in Planetary Defense

Event: **AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS (AIAA)
ASCEND LAS VEGAS**

Role: Erica Rodgers, Speaker

Topic: **Coordinating Innovative Technology Development at NASA**

Role: Thomas Colvin, Organizer and Moderator

Topic: **Finding Balance Between Chemical and Nuclear Propulsion Options for Deep Space**

Role: Laura Delgado Lopez, Panelist

Topic: **Debris Policy Gaps in Cislunar Space**

Role: Bhavya Lal, Panelist

Topic: **Nuclear Energy and Its Future Role in Space**

Role: Thomas Colvin, Panelist

Topic: **Safety First: Addressing Space Safety Priorities for a Sustainable Space Domain**

Role: Laura Delgado Lopez, Moderator

Topic: **Spaceflight Safety in a Rapidly Growing Space Community**



Laura Delgado Lopez moderates a panel.

Event: **BEYOND EARTH INSTITUTE**
Role: Bhavya Lal, Speaker
Topic: **Blueprint for Moon to Mars: Ensuring Humanity's Future in the Stars**

Event: **CONFERS GLOBAL SATELLITE SERVICING FORUM**
Role: Thomas Colvin, Panelist
Topic: **Active Debris Removal**

Event: **GODDARD SPACE FLIGHT CENTER DIWALI EVENT**
Role: Bhavya Lal, Speaker
Topic: **The Meaning of Diwali**

Event: **HAAPI OCTOBER GENERAL BODY MEETING**
Role: Bhavya Lal, Speaker
Topic: **Strengthening the AAPI Community Within NASA HQ**

Event: **MARS SOCIETY ANNUAL CONVENTION**
Role: Bhavya Lal, Speaker
Topic: **Nuclear Propulsion for Mars**

Event: **NATIONAL ACADEMIES COMMITTEE ON EARTH SCIENCE AND APPLICATIONS FROM SPACE (CESAS)**
Role: Bhavya Lal, Speaker
Topic: **Rationale for Science Station (ISAM)**

Event: **ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD) ANNUAL FORUM**
Role: Patrick Besha, Speaker
Topic: **U.S. Orbital Debris and Space Sustainability Policies**

Event: **VON BRAUN SYMPOSIUM**
Role: Bhavya Lal, Speaker
Topic: **Policy and Other Issues in the Future of Artemis**

Event: **WORLD ECONOMIC FORUM WORKSHOP**
Role: Thomas Colvin
Topic: **Best Practices for Space Traffic management (STM)**

NOVEMBER 2022

Event: **AIR TRAFFIC CONTROL ASSOCIATION (ATCA) GLOBAL**
Role: Bhavya Lal, Panelist
Topic: **Rationale for Space Exploration**

Event: **AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS (AIAA) SPACE AUTONOMY SUMMIT SPACE MISSION ARCHITECTURES PANEL**
Role: Erica Rodgers, Panelist
Topic: **Space Mission Architectures, Trusted Autonomy, Onboard Data Analytics, and Crowded Space**

Event: **AMERICAN SOCIETY FOR GRAVITATION AND SPACE RESEARCH (ASGSR) CONFERENCE**
Role: Grace Wusk, Poster Presentation
Topic: **Models for Facilitating Government-Funded Activities in the Post-ISS LEO Ecosystem**

Event: **CISLUNAR SECURITY CONFERENCE AT THE JOHNS HOPKINS APPLIED PHYSICS LAB**
Role: Grace Wusk, Poster Presentation
Topic: **Resiliency Framework for Cislunar Space**

Event: **CONGRESSIONAL HISPANIC CAUCUS INSTITUTE (CHCI) 2022 TECH SUMMIT**
Role: Laura Delgado Lopez, Panelist
Topic: **Latinos in Space**

Event: **GEORGETOWN UNIVERSITY “OUTER SPACE, STRATEGIC TECHNOLOGIES, AND INTERNATIONAL SECURITY”**
Role: Bhavya Lal, Speaker
Topic: **Future of Artemis and Space Nuclear Power and Propulsion**

Event: **GEORGETOWN SPACE LAW CLASS**
Role: Bhavya Lal, Speaker
Topic: **Space Nuclear Power and Propulsion**

Event: **GEORGIA TECH**
Role: Ellen Gertsen, Speaker
Topic: Life at the Intersection of Technology, Policy, and Strategy
Role: Patrick Besha, Speaker
Topic: Orbital Debris



Ellen Gersten and Patrick Besha speak at Georgia Tech

Event: **HARVARD KENNEDY SCHOOL**
Role: Bhavya Lal, Speaker
Topic: **60th Anniversary Moonshot: Past, Present, and Future**

Event: **MARYLAND STATE ROUNDTABLE**
Role: Bhavya Lal, Keynote Speaker
Topic: **Emerging Trends in Space**

Event: **NASA ENGINEERING AND SAFETY CENTER ANNUAL MEETING**
Role: Patrick Besha
Topic: **China’s Space Program**

Event: **SPACE AND SATELLITE PROFESSIONALS INTERNATIONAL**
Role: Nikolai Joseph, Speaker
Topic: **Space Based Solar Power**

Event: **UNIVERSITY OF SOUTHERN CALIFORNIA ASTRO STUDIO**
Role: Bhavya Lal, Speaker
Topic: **Artemis and NASA’s Exploration Plans**

DECEMBER 2022

Event: **GALLOWAY SYMPOSIUM**
Role: Gabriel Swiney, Panelist
Topic: **Legal and Policy Issues in Moon and Mars Exploration**



Office of Technology, Policy, and Strategy

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