Space Generation Fusion Forum 2022

Colorado Springs, Colorado, U.S.A
March 19, 2022 - Virtual Day
April 1-4, 2022 - Hybrid

In support of the United Nations Programme
on Space Applications

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Foreword from the Event Managers

On behalf of the 2022 organizing team, and the Space Generation Advisory Council, it was our great pleasure to conduct the 10th Space Generation Fusion Forum (SGFF). Ten years ago, the first-ever SGFF was organized in Cheyenne Lodge. Thanks to the hard work of hundreds of volunteers before us, this event has doubled in size, exploded in popularity and has obtained the capacity to reach viewers around the globe.

Most importantly, however, the success of the SGFF is a testament to the delegates. The real reason that leaders of the industry, heads of agencies and world-renowned experts return to this forum is thanks to the exciting conversations they have with our delegates.

The SGFF is designed to provide a comprehensive and diverse program that brings pertinent topics from across the current global space industry to the forefront. SGFF is dynamic, stimulating, and fun with thoughtful conversations, a creative exchange of ideas, and, most importantly, connection with an international group of peers from all sectors of the space community.

At the last SGFF, it seemed like things in the world were looking more and more certain, however, 2022 has proven to be just as unpredictable as any time since March of 2020. Indeed, over this period we've seen the greatest shift in the global political and economic landscape that likely any of us have experienced in our lifetimes. Times like this were not easy, but engaging in open and honest dialogue with an international delegation truly made a difference.

Through all of these challenges, our organizing team had been working tirelessly to make SGFF 2022 a reality. We would like to personally thank each of them, as well as the rest of the SGAC who helped to bring us to where we are today. We would also like to extend a special thank you to the Space Foundation whose generous support, guidance, and feedback allow us to bring the delegates to a stunning venue, and reach a wide audience online. Finally, we have to thank each of our sponsors, who supported us not only financially, but also by providing us with speakers, experts and mentors to fill our exciting program.

Tasman Powis
SGFF Manager

Simon Shuham
SGFF Deputy Manager

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SGFF Manager

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Space Generation Fusion Forum Overview

Held annually at the scenic Broadmoor Resort in Colorado Springs, Colorado, U.S.A., in conjunction with the Space Symposium, the Space Generation Fusion Forum (SGFF) is a multi-day, high-intensity, fast-paced professional development and networking event focused on the global space industry. Students and young professionals from around the world who are working and participating in all facets of the space community apply to attend SGFF each year.

Through breakout sessions, expert panels, keynote presentations, and speed networking, SGFF delegates "fuse" their unique perspectives and backgrounds to formulate solutions to global problems of interest and importance to the space community. By attending SGFF, delegates learn from each other and from experts, share their knowledge, network with fellow students and young professionals in the space industry, and meet international leaders in the space field.

All output and content produced by the discussions held during the Space Generation Fusion Forum are compiled into a report for the United Nations Committee on the Peaceful Uses of Outer Space. This report is presented at the Committee's annual General Assembly and at other conferences around the world.

Organising Team

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Programme

Virtual Day - 19th March, 2022 (Mountain Daylight Time GMT -6)

Time	Programme	Speaker / Sponsor
11:00 AM - 11:10 AM	Welcome Remarks	Tasman Powis
11:10 AM - 11:55 AM	Astronaut Keynote	Tony Antonelli
11:55 AM - 1:15 PM	Breakout Session Introductions	Lockheed Martin Coalition for Deep Space Exploration Northrop Grumman AIAA Atomos Space BryceTech Nanoracks American Astronomical Society Secure World Foundation SGAC Policy Task Force
1:30 PM - 2:30 PM	Breakout Session Deep Dives	Break
		Lockheed Martin Coalition for Deep Space Exploration Northrop Grumman AIAA Atomos Space BryceTech Nanoracks American Astronomical Society (in kind support) Secure World Foundation (in kind support) SGAC Policy Task Force
1:30 PM - 2:30 PM	Virtual Networking Session	N/A

Programme

Day 1 - 1st April, 2022 (Mountain Daylight Time GMT -6)

Time	Programme	Speaker / Sponsor
5:00 PM - 6:45 PM	Garden of the Gods Hike	N/A
7:00 PM - 9:00 PM	Welcome Reception at Jack Quinn's	Jean Michael / Aerospace Corporation

Programme

Day 2 - 2nd April, 2022 (Mountain Daylight Time GMT -6)

Time	Programme	Speaker (if necessary) / Sponsor
11:00 AM - 11:15 AM	Opening Remarks	Tasman Powis
11:15 AM - 11:30 AM	Welcome from the Space Foundation	Steve Eisenhart / Space Foundation
11:30 AM- 12:10 PM	Lunch Keynote	Amy Lo / Northrop Grumman
12:10 PM - 1:00 PM	Lunch & Networking	Northrop Grumman
1:00 PM - 1:40 PM	Space Policy Fireside Chat	David Lindgren Bhavya Lal Jo-Anne Sears / Velocity Government Relations
1:40 PM - 3:50 PM	Breakout Session	Lockheed Martin Coalition for Deep Space Exploration Northrop Grumman AIAA Atomos Space BryceTech Nanoracks American Astronomical Society (in kind support) Secure World Foundation (in kind support) SGAC Policy Task Force
3:50 PM - 4:10 PM	Coffee Break	Northrop Grumman

Programme

Day 2 - 2nd April, 2022 (Mountain Daylight Time GMT -6)

Time	Programme	Speaker (if necessary) / Sponsor
4:10 PM - 5:10 PM	Professional Development Panel	Debra Facktor (moderator) Lauren Lyons Lauren Smith John Conafay Davide Petrillo
5:10 PM - 5:55 PM	Keynote	Jena Garrahy / NASA SCaN
6:00 PM - 6:45 PM	Networking Reception	N/A
7:00 PM - 10:00 PM	Dinner at Phantom Canyon	Ricki Clausen (moderator) / Ball Aerospace Madeline Cowell / Ball Aerospace

Programme

Day 3 - 3rd April, 2022 (Mountain Daylight Time GMT -6)

Time	Programme	Speaker (if necessary) / Sponsor
8:45 AM - 9:00 AM	Arrival Coffee	ABL Space Systems
9:00 AM - 9:10 AM	Overview of the Day	Simon Shuham
9:10 AM - 10:10 AM	International Military Leaders Panel	Brian Weeden (moderator) Maj. Gen. DeAnna M. Burt Brig. Gen. Michael Adamson Air Vice-Marshall Catherine Roberts Air Vice-Marshall Paul Godfrey
10:10 AM - 10:30 AM	Coffee Break	Scot Forge
10:30 AM - 11:40 AM	Breakout Sessions	Lockheed Martin Coalition for Deep Space Exploration Northrop Grumman AIAA Atomos Space BryceTech Nanoracks American Astronomical Society (in kind support) Secure World Foundation (in kind support) SGAC Policy Task Force
11:40 AM - 12:10 PM	Lunch & Networking	Lockheed Martin
12:10 PM - 12:50 PM	Lunch Keynote	Cassie Lee / Lockheed Martin

Programme

Day 3 - 3rd April, 2022 (Mountain Daylight Time GMT -6)

Time	Programme	Speaker (if necessary) / Sponsor
12:50 PM - 1:10 PM	Lunch & Networking	Lockheed Martin
1:10 PM - 2:00 PM	Breakout Session Outbriefs	Lockheed Martin Coalition for Deep Space Exploration Northrop Grumman AIAA Atomos Space BryceTech Nanoracks American Astronomical Society Secure World Foundation SGAC Policy Task Force
2:00 PM - 2:20 PM	Lightning Talk	Laura Means
2:20 PM - 2:40 PM	Lightning Talk	Dr. Katherine Calvin
2:40 PM - 3:20 PM	S'Mores Break	Astroscale
3:20 PM - 4:20 PM	Climate Change Panel	Manwei Chan (moderator) Robbie Schingler / Planet Bryn Orth-Lashley Jeff Rex

Programme

Day 3 - 3rd April, 2022 (Mountain Daylight Time GMT -6)

Time	Programme	Speaker (if necessary) / Sponsor
4:20 PM - 5:40 PM	Speed Networking	Madison Telles (moderator) Lockheed Martin Hedron Ursa Major Draper Spire Orbit Fab Loft Orbital LeoLabs BryceTech
5:40 PM - 6:40 PM	Speed Networking Reception	Lockheed Martin Hedron Ursa Major Fraper Spire Orbit Fab Loft Orbital LeoLabs BryceTech
7:00 PM - 9:00 PM	Discover What's Next 10 Year Anniversary Reception	Space Foundation

Programme

Day 4 - 4th April, 2022 (Mountain Daylight Time GMT -6)

Time	Programme	Speaker (if necessary) / Sponsor
8:15 AM - 8:30 AM	Scholarship Presentations	Tasman Powis
8:30 AM - 9:00 AM	Commercial Space Stations - Talk 1	BreeAnn Edris / Lockheed Martin Rowan Palmer Eric Ingram Anna Voelker
9:00 AM - 9:20 AM	Commercial Space Stations - Talk 2	Erika Wagner / Blue Origin
9:20 AM - 9:40 AM	Commercial Space Stations - Talk 3	David Zuniga / Axiom Space
9:40 AM - 10:00 AM	Coffee Break	a.i. solutions
10:00 AM - 10:15 AM	Opportunities with the IAF	Dr. Christian Feichtinger

Programme

Day 4 - 4th April, 2022 (Mountain Daylight Time GMT -6)

Time	Programme	Speaker (if necessary) / Sponsor
10:15 AM - 11:15 AM	Heads of Agencies Panel	Chirag Parikh (moderator) Kenneth Bowersox Lisa Campbell Dr. Joseph Aschbacher Dr. Paul Bate Enrico Palermo Dr. Walther Pelzer
11:30 AM - 11:45 AM	Club for the Future	Michael Edmonds / Blue Origin
11:45 AM - 12:00 PM	Closing Remarks	Tasman Powis & Simon Shuham

Astronaut Keynote

11:10 AM - 11:55 PM

Kicking off the SGFF Virtual Day, retired astronaut Tony Antonelli shared his unique experience on orbit through a series of personal and public photographs. He then spent most of his time answering questions on the lessons he learned through his rich and varied career.

Day 1

1st April 2022

Day 1 was a fun introduction to SGFF and was comprised of two side event activities that included an exciting hike in the morning as well as a warm reception at Jack Quinn's in the evening.

Lunch Keynote

11:30 AM - 12:10 PM

While the James Webb Space Telescope was in the process of calibrating its instruments out at the L2 Lagrange Point, Dr. Lo was providing our audience with unique insights into the design and development of this groundbreaking instrument. This included a discussion on the major technical hurdles faced in building the bespoke hardware, as well as the human challenges of being a manager for such an ambitious project.

Space Policy Fireside Chat

1:00 PM - 1:40 PM

The SGAC's David Lindgren moderated this Fireside Chat between Jo-Anne Sears of Velocity Government Relations and Bhavya Lal from NASA Headquarters discussing the similarities and differences of their approach towards policy making within the space sector. The veterans of policy and government relations then shared with our delegates how they can leverage their own strengths to make a lasting impact within the space sector, both now and in the future.

Professional Development Panel

4:10 PM - 5:10 PM

Moderated by Airbus's Debra Facktor, the Professional Development panel brought together Young Professionals from across the space sector to discuss their unique career and pathways, while sharing lessons for our delegates on how best to make decisions which will shape their own futures.

NASA SCaN Keynote

5:10 PM - 5:55 PM

Through her engaging speaking approach and plenty of anecdotes, Mrs Garrahy brought the exciting world of space communication to life for our delegates. This included discussions on how to build out our deep space network, ensure secure and reliable communication systems and prevent conflict in space by managing cyber-threats.

International International Military Leaders Panel

9:10 AM - 10:10 AM

Moderated by Brian Weeden of the Secure World Foundation, this panel was the first time that more than a single military leader had come together at an SGAC event. Representing the United States, Canada, Australia and the United Kingdom, these leaders provided our mostly civilian delegation with an understanding of the similarities and differences between civilian and military space. They also generously offered their time to answer questions openly and candidly.

Lunch Keynote

12:10 PM - 12:50 PM

Lockheed Martin plays a wide and varied role within the space community, including building some of the most advanced weather and climate satellites. Ms. Lee was the perfect person to explain these systems to us, and how their unique capabilities are changing life here on Earth. We learned the difference between weather observations and those used in climate change, and how the GOES-R satellites are being used to tie these two observations together to make predictions about the future.

Climate Change Panel

3:20 PM - 4:20 PM

Viewing climate change through the lens of small-satellite operators, the Climate Change Panel, moderated by SGAC's Mandwei Chan, brought together perspectives from organisations which are attempting to disrupt the industry. It was clear that new ways to collect data, through satellite constellations, and process them, through artificial intelligence are crucial to managing the current and future risks of our changing planet.

Speed Networking

4:20 PM - 5:40 PM

The speed networking event provided an opportunity for our delegates to ask more individual questions to representatives from some of the most exciting companies in the space industry. Two representatives from each company rotated through the delegate's tables to discuss their company and current job opportunities. This was followed by a more informal networking reception.


Robbie Schingler


SPACE GENERATION
FUSION FORUM 2022

Space Access Panel

8:30 AM - 9:00 AM

Moderated by BreeAnn Edris, the Space Access Panel explored how future access to space would be more inclusive to all the inhabitants of spaceship Earth. This included providing access to those representing underprivileged communities as well as enabling those with mental or physical impairments.

Commercial Space Station Presentations

Dr. Wagner of Blue Origin and Mr. Zuniga of Axiom Space shared their company's visions for a future of working on orbit through commercial space stations.

Heads of Agencies Panel

10:15 AM - 11:15 AM

Led by the Secretary of the National Space Council, Mr Chirag Parikh, The Heads of Agencies Panel represented the first time that the SGAC had brought together six agency leaders to answer questions from our delegates. Topics ranged from international collaboration, the Artemis Accords as well as topics on sustainability and climate change. The leaders were happy to answer tough questions from our delegates on inclusivity, the weaponization of space and even the war in Ukraine. Many leaders stayed behind to mingle with our delegation in a dedicated coffee break.


SPACE GENERATION
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Garden of the Gods Hike

An optional casual hike led by the SGFF team for delegates who arrived early into Colorado Springs. The hike took in the stunning scenery at the Garden of the Gods Natural National Landmark in Colorado Springs, Colorado.

Reception at Jack Quinn's 7:00 PM - 9:00 PM

Thanks to the Aerospace Corporation, delegates were welcomed to Colorado Springs with a reception at Jack Quinn's. Jean Michael from Aerospace kicked things off by sharing some important career lessons for the next generation of space leaders. Following the talk, delegates were able to network and get to know each other in an informal setting before the first day of the conference.

Sponsored by:

Dinner at Phantom Canyon 7:00 PM - 10:00 PM

With thanks to Ball Aerospace, the dinner on the first day of the conference was held at the Phantom Canyon Brewery. This featured a fantastic panel with Ball scientist and engineer Madeline Cowell, who educated delegates on how geospatial data is used to improve life on Earth. This included recorded comments from the Phantom Canyon Brewer, relating space data to the drinks being brewed at the venue.

Delegates were treated to a buffet dinner and fresh drinks made fresh at the venue.

Sponsored by:

SPACE FOUNDATION

Space Foundation Reception 4:00 PM - 9:00 PM

Thanks to the Space Foundation, our delegates were welcomed to the Discovery Center in Colorado Springs, where they could enjoy light snacks, drinks and the opportunity to mingle with experienced members of the space community.

Sponsored by:

Euroconsult

REDWIRE

SGAC/Redwire/Euroconsult Reception 5:30 PM - 7:30 PM

Thanks to Redwire and Euroconsult the SGAC was able to host a reception during the 37th Space Symposium with the aim of bringing together all generations through the focus of improving life on Earth and in space. This included speeches from leaders of each of the organizations and plenty of opportunities for networking.

Breakout Session 1: AIAA

Orbital Debris Removal and Mitigation

Supported by:

AIAA
SHAPING THE FUTURE OF AEROSPACE

As space gets busier, it also gets messier. Over the coming years, thousands of payloads are expected to be launched by the commercial sector alone, adding to the 4,000 already active satellites in orbit. With approximately 25,000 pieces of debris larger than 10 centimetres tracked in orbit and much more untracked, the rise in space activity will lead to even more debris, increasing collision risk.

With increasing concern of threat, the need to address orbital debris is front and centre. This breakout session explored this further and identified the challenges and gaps in the orbital debris industry. Keeping that overarching idea in mind, we used guiding questions to help frame our solutions. We divided our team of 10 delegates into 3 working groups, focusing on the technology, business, and policy aspects of tackling space debris, and came up with a total of 11 recommendations for everyone to review.

Main Objectives

1. To be well-informed and up-to-date with the issue of orbital debris, and identify potential challenges and gaps.
2. To brainstorm solutions and recommendations to address orbital debris mitigation and remediation from technology, business, and policy standpoints.
3. To engage in conversations about space sustainability and keep the discussions going beyond the working group.

Subject Matter Experts

Alyssa Goessler | Dual Master's Student in Global Policy and Middle Eastern Studies | The University of Texas at Austin

Kit (Andrew) Kennedy | Starfish Space | Principal Autonomy Engineer

Luc Riesbeck | Astroscale | Space Policy Researcher

Simran Dhoju | Brooke Owens Fellowship | Incoming Systems Engineer at Planet

Moderator

Evelyn Kent | Air Force Research Laboratory | Mission Operations Deputy

Rapporteur

Questions

1. Beyond what is already in development, what standards could be developed in the future to enable OOS (e.g., modular satellites, DPs., interfaces)?
2. How can we engage with government and commercial stakeholders to develop a robust business case and incentives for the responsible and sustainable use of space?
3. How can we work with the policymakers on norms and regulations that can remind and encourage the companies to plan their missions around space sustainability/orbital debris mitigation?

Answers

1. To combat the growing risk of orbital debris from a technological standpoint, the newer technologies should be serviceable and interface-friendly. The architectures must be capable of mission repurposing, whether it is by creating a docking mechanism that can be adapted for on-orbit servicing or by reusing the same technology for multiple missions. There should also be an open-source public domain to share lessons learned, emerging ideas, and best practices, amongst various companies striving to mitigate future orbital debris. The industry can also benefit from having mentorship programs between newcomers and well-established entities to encourage sustainable use of space.
2. To develop incentives for the sustainable use of space, we can take inspiration from X-prize, which uses private funding to incentivize innovation in technology. A similar idea can be applied to provide monetary incentives for new businesses that can come up with cutting-edge technologies or state of art ideas to mitigate orbital debris. Moreover, from a policy standpoint, the long timelines to establish international space law is a major hurdle. For this, domestic governments should be encouraged to implement binding rules and regulations for both civil and state entrants to space, which promotes best practices for orbital debris mitigation.
3. To encourage companies to plan their missions around space sustainability, an international rating system like the Space Sustainability Rating by World Economic Forum and MIT should be promoted. There should also be a review committee within domestic regulatory bodies that can assess whether a new technology is sustainable and does not become debris after mission completion. This kind of review should be done earlier in the development process so that changes can be implemented. Moreover, there should be an emphasis on creating educational programs, informational campaigns, and foreign exchange programs to foster international sharing of ideas for space sustainability.

Recommendations

Question 1

Conclusions/Recommendation #1: The UN should develop a standardized public domain digital template for open sharing of lessons learned, devices, techniques, and state-of-the-art development and operations practices for mitigating future orbital debris. This internationally aggregated data repository should continuously inform standards and techniques focused on mitigating as well as removing space debris.

Conclusions/Recommendation #2: The UN should establish an interactive framework for commercial and government contributions to an interconnected infrastructure across the space domain enterprise that enables better communications, autonomy, and space domain awareness to avoid the future orbital debris. In the design of this type of hub, The UN should strive to make it "living" so that it can be continuously iterated upon and added to.

Conclusions/Recommendation #3: The UN should create a mechanism for mentorship between experienced, well-established entities and newcomers to the industry to encourage the use of readily available validated technologies, software, and methods to mitigate the risk of collision with inert objects and to self-remove from orbit after the end of life.

Conclusions/Recommendation #4: The UN should strongly advise member states to integrate software architectures that are capable of mission repurposing, for example, re-tooling that enables future docking operations.

Conclusions/Recommendation #5: The UN should investigate the benefits of reusable/recyclable materials and components to alleviate the additional buildup of orbital debris through advocacy for more reusable, modular, and recyclable materials and components.

Question 2

Conclusions/Recommendation #1: Noting the long timelines to establish international law through treaty or customary international law, domestic governments should take action to implement binding law or regulation upon civil and state entrants to the space domain which promotes best practices for orbital debris mitigation.

Conclusions/Recommendation #2: The international community should consider establishing a court of arbitration with jurisdiction to hear issues regarding orbital debris generation or undue risk in the space domain.

Conclusions/Recommendation #3: Monetary incentives for new businesses and organizations to pursue debris mitigation for the public good. X-prize is a great example of using private funding to incentivize innovation in technology as well as new ways of developing technology.

Question 3

Conclusions/Recommendation #1: Implement an international rating system with building incentives promoting the transparency and sharing of designs, policies, data, etc.

Conclusions/Recommendation #2: Begin an educational and information campaign to emphasize to the public the connection between space and the human experience, and the risks present.

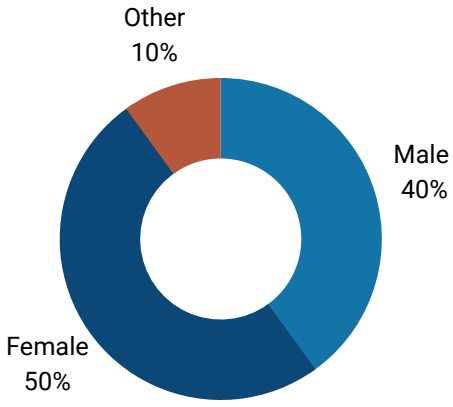
- Includes a focus on industry and younger generations in grade schools to inform and educate on debris mitigation and remediation.
- Should include an exchange program among foreign companies, including engineers, students, and other professionals to foster the international sharing of ideas and policies.

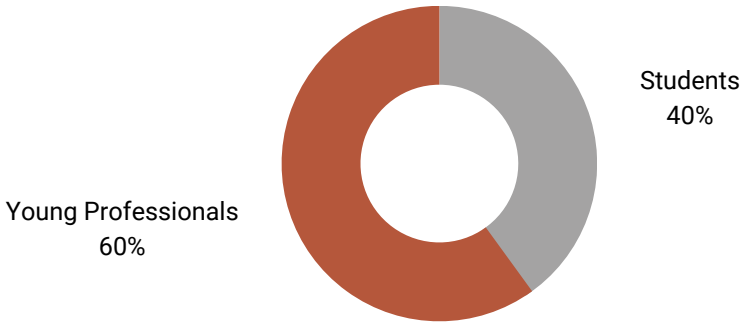
Conclusions/Recommendation #3: Encourage domestic regulatory bodies to begin the environmental review earlier in the application and registration process and throughout the life cycle of their product.

- The goal is to encourage companies to think about the environmental impacts of their designs and activities as an ongoing process.

Statistics

10 Delegates
4 Nationalities





Breakout Session 2: Atomos Space

Fad Wars - How to identify actual space needs and turn them into investable space startups

Supported by:

ATOMOS

The Atomos Space Breakout Sessions “Fad Wars” aim to brainstorm with delegates the tools, steps and awareness needed to identify real gaps in the sector for potential startups to fill in.
To do this, the sessions were structured as follows:

1. The first (virtual) session discussed gaps in (aero)space for startups to fill in, with the delegates asked to brainstorm and identify current unmet needs in the sector
2. The second session focused on turning the gap into a business. Delegates will brainstorm on how to turn a need/idea into a company worth investing in
3. The third session was a short pitch competition/shark tank with Atomos playing the role of investors, to give feedback on what investors want and what startups should focus on to be well grounded when raising funds

This series of sessions resulted in a set of best practices for wannabe startup founders and space investors alike to help identify and better understand what kind of ideas should be funded today for a more thriving and healthy space sector tomorrow.

Main Objectives

Outline a set of best practices for wannabe startup founders and space investors alike to help identify and better understand what kind of ideas should be funded today for a more thriving and healthy space sector tomorrow.

Subject Matter Experts

Vanessa Clark | Co-Founder, Chief Executive Officer | Atomos Space

William Kowalski |Co-Founder, Chief Executive Officer | Atomos Space

Matteo Cappella | Regulatory Affairs Specialist | Leaf Space

Moderator

Michael Barton | Sales and BD Manager | a.i. solutions

Moderator

Questions

1. What are the gaps in the aerospace sector that startups can fill in?
2. How do we turn these gaps into actual businesses worth investing in?
3. How can founders pitch these ideas in a well grounded way to investors?

Answers

1. While many investments are being made into over-subscribed areas such as small launches, there are gaps that show more potential for investment including automation and standardization of satellite operations, reducing satellite manufacturing and integration costs and timelines through lower-lifetime mission design, LEO-based GNSS alternatives, and more robust on-orbit communication subsystems.
2. Founders must find ways to turn ideas into ROI in shorter timelines, which is hard to do in space! Services-based concepts (XaaS) provide a source of predictable income and incentives efficiencies, so they might be a great way forward.
3. Founders should focus on talking about the problem from the customer's point of view, explain why their solution to the problem is excellent, speak to why they have the right team in place, and then close with explaining how investors will profit.

Recommendations

Question 1

Conclusions/Recommendation #1: You must like the people you're working with and believe in the mission. Startups are very difficult and if you're in it for the money you will fail.

Conclusions/Recommendation #2: You have to be in love with the problem, not the solution. Being in love with one solution is not a market-driven approach, and your solution may need to change over time.

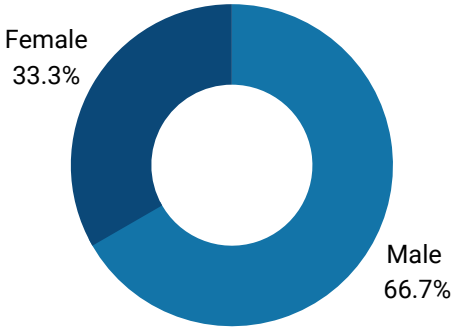
Question 2

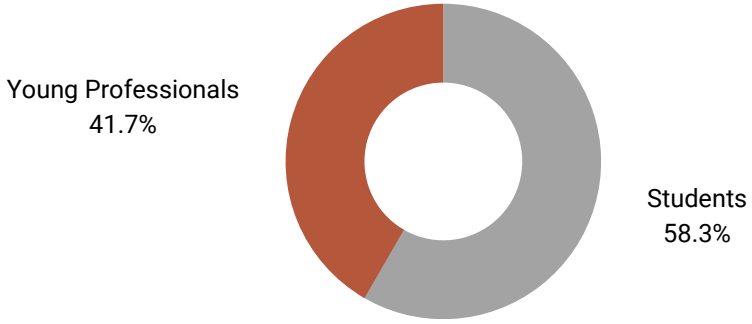
Conclusions/Recommendation #1: The space community, particularly the startup/investment community, needs to talk more about the quality of current space investments. Bad investments can quickly turn the financial markets against the space community, impacting the success of all future space startups.

Conclusions/Recommendation #2: Most likely there is currently too much investment in small/medium launches, micro propulsion, spaceports, and space tourism. Particularly for small launches, the market cannot support nearly all of the currently-funded ventures, and all of them are claiming a substantial market share, leading investors to believe the total market and profit opportunity is larger than possible. This can easily lead the market to sour on space investments.

Statistics

12 Delegates
3 Nationalities





Breakout Session 3: BryceTech

Investing and entrepreneurship

Supported by:

Governments have long been the incubator of private sector innovation, ranging back to the roots of Silicon Valley in Fairchild Semiconductor's DoD contracts. Today, national space agencies and militaries continue to serve as the core customer for space companies, whether through large-scale contracts (e.g., Artemis) or through Innovation grants/funding (e.g., the SBIR / STTR programs). However, as we move beyond human spaceflight into the next wave of activity in space - satellite servicing, on-orbit manufacturing, space traffic coordination, the broader LEO economy - private sector funding and exclusively private sector-oriented business models are becoming increasingly meaningful as part of the overall space ecosystem. But, government programs are not stopping, and leaders have not yet determined that there is no "no" function for government in what had previously been entirely government activities.

This working group discussed how the private sector (investors and companies) should work with governments in advancing innovation within the space ecosystem while developing sustainable investment frameworks. The U.S. government can provide a framework, given its robust history of documenting its policies with each administration.

Main Objectives

1. This session should seek to answer the questions in the bullets offered below. Given the increasing nature of investments in space capabilities, given the speed of innovation in space being greater in the private sector than in the public sector, and given the long-standing reference to space capabilities as "dual use", the documents that guide any government's approach to space activities, if examined, are likely limited in their ability to provide effective guidance on how to leverage investments and innovation happening in the private sector.

Throughout the past several decades of setting space policy in the U.S., the phrase “maximum practical extent” has been used to characterize how the U.S. government should use commercial services. And in the 2010 U.S. National Space Policy and the 2021 U.S. Space Policy Framework definitions of commercial space were offered.

- Is it time for a more actionable phrase to be used in future policies? If so, please craft one.

2. This is not the first time in recent memory that significant plans, new investments, and exciting commercial capabilities have been promised in the space sector. In the mid-to-late 1990s, there were several plans for constellations of satellites to provide global telephonic communications. These plans never really materialized - in no small part because of the rapid development of terrestrial wireless. Many companies had to handle significant losses, and the U.S. government had to heavily subsidize several companies.

- Of all the areas of investment taking place now - where is the greatest risk of failure due to alternative technology solutions (terrestrial, airborne, etc.)?
- What are the investments that should be made to accelerate space-based services to reduce this risk?
- Should the government explicitly partner with industry to address these risks? And if so, how?

3. The space industry remains intertwined with the government, the technology has long development horizons, and there is some randomness inherent to performance (launch failures, etc.). Combined - it's not always easy to fit this business into the standard quarterly breakdown.

- Might we better understand the performance of our industry if we considered an alternative? Instead of quarterly reporting, perhaps thirdly (once every four months)?
- Should there be a new, different standard for understanding the performance of space business ventures? What would the group recommend? What would it take to get the investment community to adopt a different model?

Subject Matter Experts

Carrie Mullins | Director of Analytics and Intellectual Property | BryceTech

Ajeet Hansra | Director, Private Equity | EQT Group

Moderator

Questions

1. How can government better drive innovation within the private space sector?
2. How can government encourage a commercially viable in-space economy?

Recommendations

Question 1

Conclusions/Recommendation #1: Government support should be encouraged not only at the federal level but also at state/local levels to drive innovation, manufacturing and job creation in smaller communities. Examples include the creation of innovation hubs and dedicated education programs.

Conclusions/Recommendation #2: Government should provide additional "soft" support to recipients of small-scale government funding grants (for example the Small Business Innovation Research grant in the United States). This could include incubator programs, business or technical training, assignment of experienced mentors or networking/ events for space startups.

Conclusions/Recommendation #3: Governments should consider or continue to pursue matched incentive programs, whereby funding levels are tied to the level of private capital accrued by the funded business.

Question 2

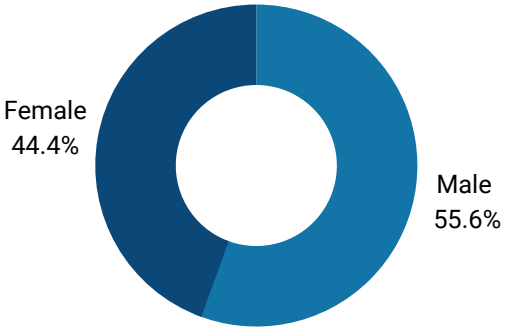
Conclusions/Recommendation #1: Governments should encourage and support treaties/policies which act to de-conflict contested space resources. For example, LEO congestion, GEO orbits, and EM spectrum. These should be encouraged domestically even if international agreement cannot be obtained.

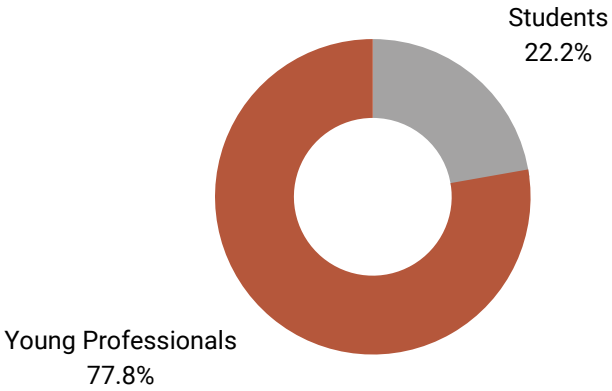
Conclusions/Recommendation #2: Governments should adopt standards and best practices for spacecraft operation and hardware development to streamline public-private and private-private inter-operability.

Conclusions/Recommendation #3: Governments should clearly signal their intentions within the space environment (whether for civil or military purposes) in a way that allows commercial entities to plan around any potential conflicts.

Statistics

9 Delegates
2 Nationalities





Breakout Session 4: CDSE

Humans vs. Robots in Space

Supported by:

THE COALITION FOR DEEP SPACE EXPLORATION

As NASA's Artemis program nears its goal of returning humans to the Moon, in the 50 years since Apollo, robotic spacecraft have visited every planet in the solar system, mapped other worlds, ventured into interstellar space, returned samples from comets, and soon asteroids and even Mars. Yet, as sophisticated as robotic spacecraft are, they lack the integrated capabilities that make humans fast decision-makers. Human spaceflight doesn't only enable more innovative space activities but also helps advance Earth-bound objectives. For all its benefits, human space exploration is much more expensive and dangerous than robotic missions and faces negative opinions both in the space community and beyond. These negative perceptions can jeopardize support for exploring deep space with humans. There are critical conversations relative to established economies, space for space's sake, integrated technologies, and how new solutions can benefit Earth.

Main Objectives

1. Determine potential objectives of human deep space exploration missions and if there is any benefit or potential for a meaningful lunar economy with or without in-situ human involvement?
2. Evaluate potential overlap with UN-oriented purpose and goals
3. Uncover potential messaging for the general public to garner support for deep space exploration missions

Subject Matter Experts

Jamil Castillo | Manager, Space Policy and Digital Communications | Coalition for Deep Space Exploration

Madison Telles | Systems Engineer, Safety & Mission Assurance | Virgin Orbit

Moderator

Paige Arnold | Young Professional (Communications) | Del Valle Creative

Rapporteur

Anja Sheppard | Bachelor Student (Engineer) | University of Texas at Dallas

Rapporteur

Nicholas Florio | Young Professional (Engineer) | Lockheed Martin Space

Rapporteur

Newsha Haghgoo | Space Exploration Project Group Co-Leader (Engineer) | Space Generation Advisory Council

Rapporteur

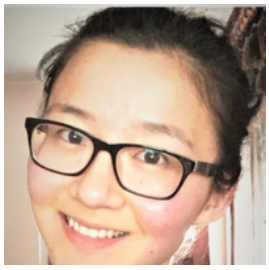
Madison Diamond | Master Student (Scientist) | University of North Dakota

Rapporteur

Cody Knipfer | Young Professional (Policy & Legal) | Virgin Orbit

Sapna Rao | Young Professional (Engineer) | Lockheed Martin Commercial Civil Space

Tejasvi Shivakumar | PhD Student (Scientist) | University of Nottingham



Zhen Cahilog | Young Professional (Healthcare) | NHS England

Questions

1. What are some of the main goals we are trying to achieve with humans in deep space exploration?
2. Can goals such as creating a lunar economy or discovering how to extract resources that could make deep space exploration self-sustainable advance if we only send robots?
3. Let's try to clearly delineate the benefits that come from humans working with robots as opposed to either working by themselves. How about Earth-bound goals such as UN Sustainable Development Goals?
4. Drawing from the answers to the questions above, how can we better communicate both with the space community and with non-space professionals about the rationale and importance of human space exploration?

Answers

1. Humans in space are a reflection of humans on Earth (like a mirror!) and that benefits the arts, sciences, humanities, education, and more. Creating a human economy in space creates economic, technological, and socio-ecological opportunities on Earth

2. Humans and robots in space are complementary – we can't explore/develop space with one and not the other, and together they accelerate our progress in space. Sustained human presence in space is inspirational and aspirational, benefiting education and workforce development.

3. Addressing the technological challenges to sustained human presence in space addresses global sustainability goals:

- Access to food
- Access to more effective healthcare
- Clean water

Since the space environment is analogous to remote communities on Earth, developing space infrastructure for humans directly aids remote countries.

4. Astronauts are better storytellers and robots.
Growing the diversity of human experience in space inspires a diversity of action on Earth.

- High visibility
- High impact
- Astronauts are role models and communicators.

Humans in space break down our artificial boundaries - encouraging inclusivity. Space is a global boundary that should be explored and accessed by all.

Recommendations

Question 1

Conclusions/Recommendation #1: Create pipelines for more nations, including emerging space nations and underrepresented communities, to send humans into space.

Conclusions/Recommendation #2: Develop a global program to establish more human spaceflight contract initiatives in order to promote international collaboration.

Question 2

Conclusions/Recommendation #1: Promote the importance of human-robot collaboration in advancing space exploration for furthering human knowledge.

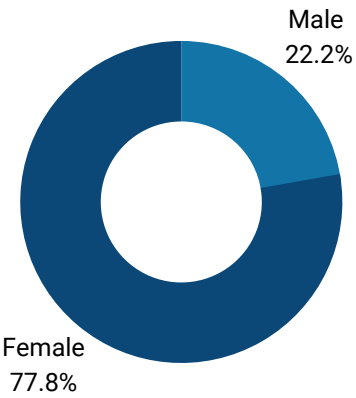
Conclusions/Recommendation #1: Encourage companies, agencies, and governments to adopt public and corporate social responsibility by transferring the benefits of human spaceflight technology to problems we face here on Earth. For example, telehealth developed for astronauts in space can benefit people living in remote areas on Earth.
Conclusions/Recommendation #2: Pursue a global understanding of how the Moon and Mars are potential extensions of current urban development and agricultural architecture that can inform enhancements in space.

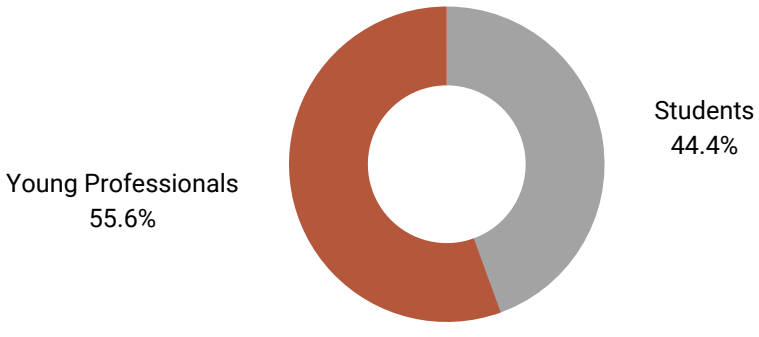
Question 4

Conclusions/Recommendation #1: Develop an international understanding of cost/benefit analysis that space is a testbed for innovation, economic growth, and diversity initiatives that has a daily impact on Earth.
Conclusions/Recommendation #2: Incorporate targeted messages about the importance of human spaceflight into existing United Nations educational initiatives.

Statistics

9 Delegates
3 Nationalities





Breakout Session 5: Lockheed Martin

Developing an Accessible Lunar Infrastructure

Supported by:

LOCKHEED MARTIN

The lunar infrastructure is going to be developing substantially in the next 10 years. With this development comes the need for a solid, connected infrastructure comprised of different lunar operations. Some of these include surface power, lunar communications, lunar mobility, and lunar habitats. For surface power, Lockheed Martin has been looking at nuclear and solar power technologies. Power will be essential to keep the entire lunar infrastructure running. Communications is another crucial area for ensuring connectivity which Lockheed Martin's lunar communications, Parsec, will address. Surface mobility is another essential lunar operation and allows easy crew and robotic access to different areas in the lunar infrastructure. The last portion is lunar habitats, an important technology Lockheed is developing based on the Starlab commercial LEO destinations program. Overall, Lockheed Martin has been working to lay out technologies and programs around these operations and will need to start involving the international community. This working group will tackle this problem by coming up with creative solutions for an accessible and sustainable lunar infrastructure.

Main Objectives

1. Delegates will brainstorm various methods of integrating different lunar operations. These operations include but are not limited to surface power, lunar communications, lunar mobility, and lunar habitats. Delegates are free to think of different lunar operations and provide justification. Delegates should also discuss the purpose and extensibility of each lunar operation. Additionally, delegates should discuss how various parts of the lunar infrastructure interface. The interfacing portion of this focus question is essential to increase accessibility. The delegates should discuss various ways to approach this. Another aspect of this focus question is how to ensure international partners are part of the conversation. Delegates should think of different methods for increasing international presence in the future lunar infrastructure. Interoperability can make a big difference, requiring countries/organizations to adhere to a standard allowing for easy interfacing. What would these standards look like and which elements of the Lunar infrastructure would benefit the most from interoperability?

2. Delegates will brainstorm and discuss the sustainability of lunar operations in practice. Environmental sustainability considerations should include a policy and law framework to impose on the commercial partners as they ramp up their lunar development plans. As part of the Moon to Mars vision, delegates should be mindful of planetary protection initiatives and how that will potentially shape the lunar operations. Additionally, delegates should address ways to mitigate debris as an outcome of lunar operations and how such methods would help address our carbon footprint concerns here on Earth.

Subject Matter Experts

Lindsay Papsidero | Parsec™ Program Manager | Lockheed Martin Space

John W. Ware | System Architect | Lockheed Martin

Kathy Vega Mulvaney | Systems Engineer | Ball Aerospace

Moderator

Questions

1. How can we seamlessly integrate the different operations of the Lunar Infrastructure while promoting participation and interoperability from international partners?
2. As the infrastructure expands, how can we ensure that lunar operations are environmentally sustainable?

Recommendations

Question 1

Conclusions/Recommendation #1: Establish a short set of values upon which all players will agree to. Our recommended values are as follows:

1. Protection of human life
2. Sustainability
3. Interoperability
4. Stewardship
5. Discovery & Expansion

Conclusions/Recommendation #2: Establish a dedicated international committee overseeing Lunar Infrastructure that has diverse perspectives (different nations, different entities from gov & non-gov, etc).

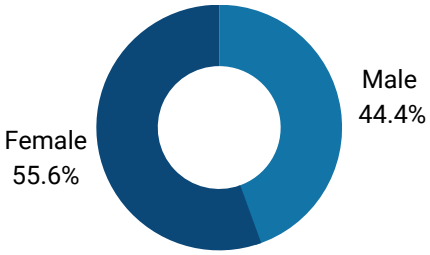
Question 2

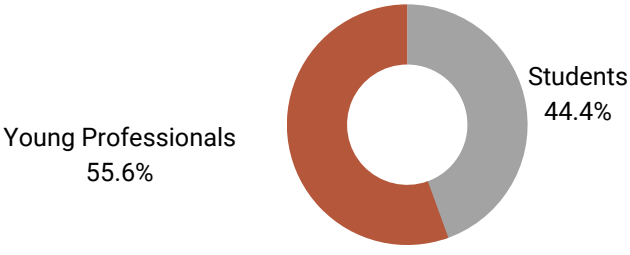
Conclusions/Recommendation #1: Develop a brief similar to the Decadal Survey, which different experts contribute to and revisit on a regular basis (every 5-10 years), setting forth best practices and areas of focus for sustainable lunar operations.

Conclusions/Recommendation #2: Determine critical and non-critical infrastructure, to assess if each respective segment should be led by industry or government. For example, Habitats and Surface Power are critical and we believe these should be regulated by the government. However, Lunar Mobility & Communications are perhaps non or less critical and could best be managed/led by industry, while abiding to values/standards set forth by the “decadal survey analogue”.

Statistics

10 Delegates
5 Nationalities





Breakout Session 6: Nanoracks

Democratizing access to space using commercial stations

Supported by:

Nanoracks

The NanoRacks breakout session focuses on exploring avenues to access and utilize space stations. NanoRacks runs the George Washington Carver Science Park on the ISS and was recently awarded $160M to work on building their own Starlab space station. In addition to manifesting science payloads, NanoRacks has also been involved with various other space station uses such as streaming the ceremonial first pitch for a Houston Astros game down from the ISS and developing educational payloads for STEM education where students can send science experiments to space. Through this breakout session, NanoRacks wants to hold a discussion with the next generation of space leaders regarding other methods to involve the space community in space station usage.

Main Objectives

1. How should Nanoracks run a competition for a space station payload that exemplifies fairness and inclusion, especially to non-traditional users of the space station platform?
2. How might Nanoracks work with the UN to expand the reach of offered space station opportunities to those outside the traditional users of the space station platform?

Questions

1. What are the criteria for selecting a competition winner that will allow a broader range of participation (beyond only scientists)?
2. How would you go about advertising this competition so that it reaches people beyond the immediate space industry?
3. Given each delegate's unique background, what types of engagement would excite people in their fields of expertise?

Subject Matter Experts

David Marsh | Strategic Lead for Space Systems & Acting Director for the George Washington Carver Science Park | Nanoracks

Manwei Chan | PhD Candidate | MIT

Moderator

Answers

1 & 2. Create an advisory board with members outside of the industry to judge a competition winner. Also, the competition can be aligned with the UN SDG goals, which can bring in interest from groups that aren't traditionally affiliated with space.

2. The UN can provide high-level guidance on private space station use and information dissemination. For example, high-level safety/verification guidelines, expectations on collaboration, and astronaut definition. The UN can also emphasize the benefits produced by space research activities to inform the general public of the benefits of space.

3. The commercial space station can develop a tech transfer program to help foster technologies that can benefit life in space and life on Earth.

Recommendations

Question 1

Conclusions/Recommendation #1: Create an advisory board with members outside of the industry to judge a competition winner.

Conclusions/Recommendation #2: Align the competition judging criteria with UN SDGs.

Question 2

Conclusions/Recommendation #1: UN should emphasize the terrestrial benefits of space-related research and activities.

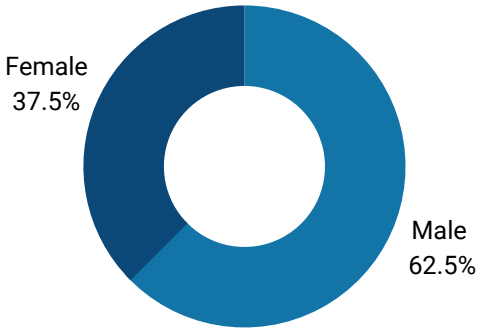
Conclusions/Recommendation #2: Allow the UN to provide high-level guidance on the operation and cooperation in using commercial space stations.

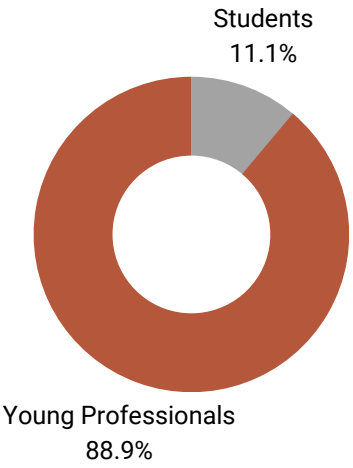
Question 3

Conclusions/Recommendation #1: Develop a tech transfer program on the commercial space station to promote the development of useful technologies within and beyond the space ecosystem.

Statistics

9 Delegates
6 Nationalities





Breakout Session 7: Secure World Foundation

What recommendations does SGAC have for the UN Open Ended Working Group (OEWG) on how to deal with destructive anti-satellite testing and other threats to space security?

Supported by:

SECURE WORLD FOUNDATION

UNITED STATES SPACE FORCE · DEPARTMENT OF THE AIR FORCE · MMXIX

The United Nations is about to convene an Open Ended Working Group (OEWG) to discuss proposals for addressing space threats, such as debris-causing anti-satellite weapons (ASAT). This breakout session brought together young professionals from six nations to discuss the most pressing threats to space safety and sustainability, with a specific emphasis on ASATs. The goal of this breakout group was to provide the future generation's perspective and recommendations on how to ensure the long-term sustainability, security and stability of space activities in the face of these threats. Facilitated by the Secure World Foundation (SWF) and the United States Space Force, SWF will take these recommendations to the OEWG to help ensure that the future generation's voice is heard in this important topic.

Main Objectives

1. Develop a holistic understanding of the threats facing space assets, with a specific focus on debris-causing anti-satellite weapons (ASAT).
2. Consider the underlying socio-economic and strategic motivations driving ASAT development and identify alternative pathways to addressing these motivations.
3. Have the participants generate a handful of actionable recommendations.

Subject Matter Experts

Dr. Brian Weeden | Secure World Foundation

Lt Col Anna Gunn-Golkin | US Space Force

Christopher Capon | Nominal Systems | CEO

Moderator

Questions

1. What should the international response to ASAT development be and how should it be regulated?
2. How do we make it in a nation's best interest to "consent to be bound" to ASAT prohibitions?
3. Why are ASAT tests bad? What is the damage from an environment, financial and reputation perspectives.
4. What is the rationale behind ASAT tests (pros and cons)? Where is the balance of the pros/cons?
5. What are the alternatives to achieve those goals through alternative means?
6. What's the pitch to countries to "consent to be bound" by a set of rules/norms? How do we make it in their national interest?

Answers

1. The primary problem with ASATs is the generation of debris, which causes long-term and sustained harm to the near-Earth space environment, creating a substantially elevated risk of conjunctions in the relevant orbit regime. This harms both current space actors and developing nations. The question was raised of whether you can have a "responsible" ASAT test if it does not generate debris. The recent Russian ASAT test was raised in this context, where there is evidence to suggest that they did not expect to create the debris that eventuated. Flowing from the conclusion was that the risk of significant harm from ANY ASAT test is non-negligible (given both complexities of the task and uncertainties involved). Hence, the conclusion was that kinetic ASAT devices are, by their nature, irresponsible, as the risks of harm involved are not balanced by the need and the lack of a strategy to remove debris other than natural orbital decay.

2. A range of rationales behind kinetic ASAT development was discussed. These ranged from strategic capability development to the political/reputational advantage (real and/or perceived) of having demonstrated ASAT capabilities (i.e. "being part of the club"). India was raised as an example, where the perception was that the establishment of the Nuclear Non-Proliferation Treaty prior to India being able to demonstrate itself as a nuclear-armed nation negatively influenced its standing (including as a permanent UN Security Council member). As a result, there was a desire to demonstrate ASAT capabilities prior to a similar ban. The primary rationale for ASAT development is likely focused on a balance of genuine capability development and strategic posturing.

3. ASAT development will continue while the strategic benefits (reputational, capability) outweigh the negative impacts. While there are negative impacts (for example, the India ASAT test contributed to shifting an Australian satellite from PSLB to RocketLabs) the short-term impact of any sanction is outweighed by the long-term impact of debris. To create an avenue for satisfying the rationale behind kinetic ASAT testing to the establishment of a national "space games" that enables States to demonstrate capability/proficiency and build national pride, with prohibited behaviour causing disqualification/loss of face i.e. Space Olympics. A formalization of the space race could help create an alternate avenue to achieve the rationale of ASAT tests, accelerate technology development without an overt military focus, and create incentives for local capability development.

4. In parallel, there were conversations around the prohibition of ASATs and how this might be achieved. Comparing the implementation of the Nuclear Non-Proliferation Treaty (A bilateral agreement between nuclear powers that expanded to a multilateral agreement) to the Landmine Convention (Huge adoption, expect by those that have and use landmines), a conclusion was that it must be in a nation's interest to "consent to be bound" by a set of rules/norms around ASATs. Similar analogies were also drawn with climate change. Following this line of reasoning, one suggestion was to establish a debris quote system following a carbon offset program type model. While not directly addressing ASATs, as the principal issue behind ASATs is debris generation, creating a market for debris removal would create flow-on financial impacts for irresponsible debris generation (i.e. ASAT tests). The goal is to increase the negative impact of ASATs on

a country to outweigh the benefits (real and perceived). A recommendation is that an independent multi-lateral body following the IAEA model should also be established to observe, monitor and attribute the use of ASAT devices, from which other external bodies can recommend and implement sanctions based on the resulting harm.

Recommendations

Question 1

Conclusions/Recommendation #1: Deliberate anti-satellite effects that create Debris must be prohibited.

Conclusions/Recommendation #2: A multilateral, independent body responsible for the observation, verification and attribution of prohibited anti-satellite effects should be established. This body should not be responsible for enforcement/response.

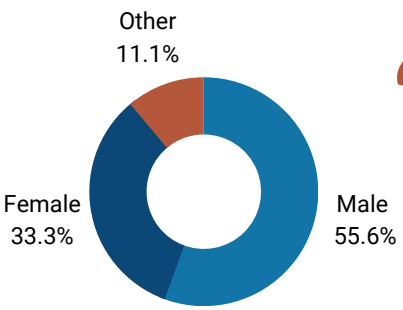
Question 2

Conclusions/Recommendation #1: Establishment of a national debris quota system to limit the generation of debris, incentivize debris removal, and support developing nations through an offset system e.g. carbon credits.

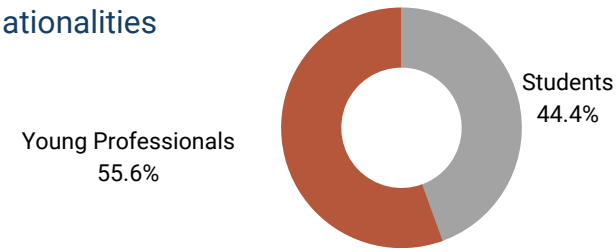
Conclusions/Recommendation #2: Establishment of the Global "Space Games" following a Google X Prize/Olympics model to create a framework for States to be able to demonstrate capability and build national pride within a rules framework.

Conclusions/Recommendation #3: It already is in the relevant nations' best interest - the nations with this capability have already tested it. The US has declared it won't do any more ASAT tests. Nations can swear off any further testing and look responsible ("gain face")

Statistics



9 Delegates
7 Nationalities



Breakout Session 8: Northrop Grumman

On-orbit Satellite Servicing

Supported by:

NORTHROP GRUMMAN

The Northrop Grumman Breakout Session aims to understand the emerging paradigm of commercial satellite servicing. The number of satellites spanning various orbital regimes is increasing, with a slate of future missions raising that number by significant orders of magnitudes (e.g., megaconstellations). The success of Northrop Grumman's Mission Extension Vehicle-1 (MEV-1) served as a first for the space industry by providing life extension capabilities, with a successful docking operation to a client satellite, Intelsat IS-901 in early 2020. This shifted the focus of the conversation to evolving operational capability and facilitating the adoption of sustainable solutions by making satellite servicing mainstream. To better understand the potential for revolutionizing on-orbit servicing and its challenges, Northrop Grumman seeks to leverage next-generation perspectives to gather novel ideas.

Main Objectives

1. How do we integrate satellite servicing into the space ecosystem?
2. How might we move forward from existing capabilities provided today to more complex operations, such as in-space manufacturing and assembly?

Questions

1. What technical systems are needed to meet the needs of multiple users?
2. How can we evolve the market to benefit from on-orbit servicing?
3. In what ways can we incentivize or create benefits to bolster the insurance industry towards sustainable solutions in space?
4. What interventions are needed to resolve regulatory and legal challenges in making satellite servicing more mainstream?

Subject Matter Experts

Lauren Smith | Program Manager, Satellite Servicing Operating Unit | Northrop Grumman

Joseph Anderson | Vice President of Business Development and Operations for SpaceLogistics | SpaceLogistics, a Northrop Grumman company

Zaid Rana | Systems Design Engineer | MDA

Moderator

Brenton Smith | Chief Technology Officer/Co-Founder | Nominal Systems

Rapporteur

Answers

1 & 2. With an emerging market, a recurring theme is the development of standards and operating norms that wouldn't stifle innovation. The ISO will soon release operating norms that ensure responsible, cooperative, and transparent satellite servicing missions. In light of this, the adoption of modular technical systems design and interoperable architectures is encouraged. Additionally, we recommend the adoption of a common lexicon of nomenclature for the on-orbit servicing industry to support future policy adoption as well as the administration of innovation competitions to incentivize the creation of standards.

3. Insurance can be seen as a primary driver of on-orbit servicing in the market, where capabilities reduce the risks of mission operations. Furthermore, we recommend international governments include on-orbit servicing and design for servicing operations in future contracts to support the emerging sector.

.

4. Communication interference with client satellites currently poses a major hurdle to servicing activities in space. Servicers currently must borrow spectrum from clients to avoid interference, but clients are operating on a variety of frequencies. We recommend that the UN and the ITU collaborate to allocate a dedicated frequency spectrum for servicers.

5. Policy considerations recognizing that satellite servicing is equally capable of deorbiting satellites at end-of-life, analogous with carbon capture or carbon footprint reduction. Current policies force operators to have a 90% likelihood of successful end-of-life disposal according to international norms, driving development costs for operators to ensure compliance. We recommend policy interventions that recognize on-orbit servicing as a compliant strategy for end-of-life disposal.

Recommendations

Questions 1 & 2

Conclusions/Recommendation #1: To administer an innovation competition to incentivise the creation of standards.

Conclusions/Recommendation #2: To create a common lexicon to be used in the on-orbit servicing industry.

Question 3

Conclusions/Recommendation #1: For international governments to drive adoption by including on-orbit servicing in their contracts and to strengthen this emerging market.

Conclusions/Recommendation #2: To engage more closely with the insurance industry with progressive indemnification solutions leveraging on-orbit servicing in reducing the cost of an operator's insurance.

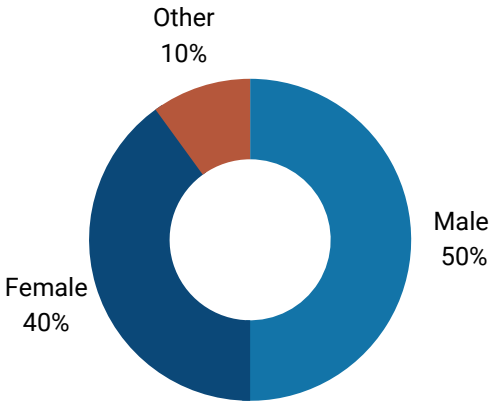
Question 4

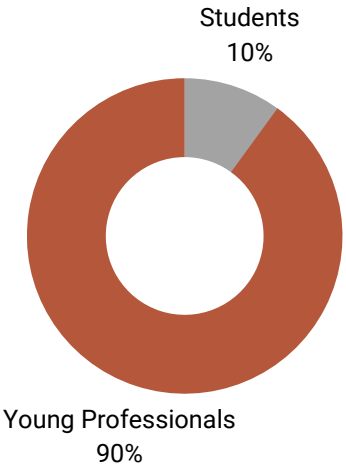
Conclusions/Recommendation #1: To advocate for and develop policy instruments that recognize on-orbit servicing as a compliant strategy for end-of-life disposal.

Conclusions/Recommendation #2: That the UN and the ITU collaborate to allocate a dedicated frequency spectrum for servicers.

Statistics

10 Delegates
5 Nationalities





Breakout Session 9: Lockheed Martin (Virtual)

Applying Space Assets to smart cities

Supported by:

LOCKHEED MARTIN

By 2050, approximately 70% of the population on Earth is expected to live in a Smart City. A Smart City is one that uses electronic methods to measure data and uses that data to manage assets, resources, and services efficiently. Such methods would help us to digitally connect the cities and communities and leverage the existing infrastructure to maximize our efficiency. The existing space assets and technologies will play a key role in the digital transformation of Smart Cities. The digital monitoring system also comes with risks, including cities being prone to cybersecurity attacks that could potentially wipe out entire power grids. This working group addressed ways in which space assets and core space technologies can help support Smart Cities through two main overarching aspects ie., the applications and their implementation.

Main Objectives

1. To discuss, brainstorm, and define the use cases for space assets to work together in order to support Smart City applications such as ground-based critical infrastructure (energy, transportation, manufacturing, water conservation, emergency services, etc.) that will positively impact our lives on Earth
2. What does a satellite architecture need to include to support these use cases? Can adequate support be provided with existing technology or are there other near-term developmental technologies that should be applied? Do we need to adapt our current ground infrastructure to allow space assets to work in tandem?

Questions

1. What are the most powerful applications of space assets to support Smart Cities?
2. How do we ensure implementation of space-based assets to support Smart Cities in a secure, resilient, and sustainable way?

Subject Matter Experts

Pete Penegor | Smart City Lead, Commercial Communication, Advanced Programs Development | Lockheed Martin

Ben Pearson | Strategic Planner with Campaign Strategy & Integration | Lockheed Martin

Swetha Kotichintala | SGFF 2022 Programs Team/ Business Development & Sales | SGAC / Exobotics

Moderator

James Xie | Engineer | Stroud International

Rapporteur

Vanessa Van Decker | Engineer | SEDS Canada, Ryerson University

Rapporteur

Answers

1. Supply Chains and Universal Access were broadly categorized into non-space-based and space-based use cases. Under non-space-based, supply chains cover the aspects of Capability management & waste reduction through improved process awareness + process control with possible labour automation, and decision-making automation which could lead to a reduction in waste in the transportation sector by reducing underutilized assets (e.g. empty trucks) and wasted goods (esp. In food). This could be achieved by decentralized communities with local resources to serve them enabling just-in-time deliveries; and the access could be through drones and supply chain automation.

Under space-based, supply chains covered Traffic management, Natural resource management, Connectivity between regions to support distributed services such as drone-based deliveries, disaster response, etc. with universal access to connecting data between different geographic areas, leap-frogging through infrastructure via Satellite-based internet etc.

2. One primary takeaway was ensuring that the implementation of “smart communities” and not just “cities” are considered - inclusive of all types of communities including those in rural or transitional areas. Making Internet access a human right i.e., Decoupling profits from deployment (not necessarily making the Internet a public service but certainly regulating it to avoid discrimination / profit-driven deployment) and starting in the places that need this infrastructure the most. Top-down regulations and norms focus on bare minimum requirements for access (e.g. base level of the internet) because demand + expectations in different cities/regions will vary greatly. Communities are empowered to utilize resources as best fit their community.

Recommendations

Questions 1 & 2

Conclusions/Recommendation #1: Logistics & Universal Access:
Delivering goods and services in an efficient manner and for Universal Access was discussed. One primary takeaway was ensuring that the implementation of “smart communities” and not just “cities” are considered - inclusive of all types of communities including those in rural or transitional areas. The recommendations were to:

- Combine ground-based sensors with space-based earth observation to support services such as traffic management and natural resource management, infrastructure development to access satellite-based internet, and reduce the barriers between different service regions where earth observation is not constrained by geopolitical borders. This adds to policy recommendations regarding Universal Access and inclusivity that will empower communities to utilize resources to best fit their community.

Conclusions/Recommendation #2: Under Data Privacy & Sharing, the key concern of keeping the vast amount of shared data secure while simultaneously promoting public trust in the system. Recommendations were made ranging from:

- Addressing the challenges of encryption of personal data, machine learning to filter the useful data and using a zero-trust network to store data that allows smart city databases to maintain privacy from unauthorized parties. For example, with a trusted system, a mass collection of bodily vital information could be used to prevent the spread of diseases and heavily monitored utility usage would aid in calculating both sustainability and disaster readiness. Data and privacy protection systems can be implemented through multi-factor verification, quantum encryption, blockchain tracking, VPNs, bio-scanning technologies, and satellites through which all data can be routed to leverage cyber-security measures.

Conclusions/Recommendation #3: Under the Disaster Response & Weather Tracking the team considered options for disaster mitigation and providing resources during and after disasters. Satellite imagery is already commonly used for disaster watching and weather but the recommendation was for the improvement of predictive models so that we are not relying too much on the historical data and track the data trends. Additionally, space-based technologies can be used to determine areas in need of the most assistance after a disaster, and drone delivery can be used to send supplies. The following recommendations build off of existing space-based infrastructure:

- Using ground and space data tied to predictive models to track and predict disasters, and continue to develop new internet, power, and other infrastructure to remain in place after a disaster.

Policy Recommendations:

1. Change the terminology to “smart communities/world” instead of “smart cities”

2. Internet as a human right
    - Decoupling profits from deployment (not necessarily making the internet a public service but certainly regulating it to avoid discrimination / profit-driven deployment)
    - Start in the places that need this infrastructure the most

3. Top-down regulations and norms focus on bare minimum requirements for access (e.g. base level of the internet) because demand + expectations in different cities/regions will vary greatly
    - Top-down state regulations bring the risk of losing smaller communities - they should survey common norms to develop rules (i.e. implement the bare minimum)
    - Top-down regulations should consider smaller/underserved communities (rural, students, poorer)
    - Take advantage of norms and “soft regulation” as communities develop their implementations to share best practices without necessarily enforcing a law (this may also be simpler + easier to implement from the legislature but is also more vulnerable to change)
    - Regulation at a federal level not at a state/municipal level at the implementation level even if it originally grows from a city at a time

4. Communities are empowered to utilize resources as best fit their community
    - E.g. better remote learning/work access from rural areas may not be as necessary for urban areas
    - Moves away from a “one size fits all” solution to tailor smart communities to different cultures and needs
    - Make governments more responsive to these technology developments, without necessarily cutting out private companies from the decision-making process

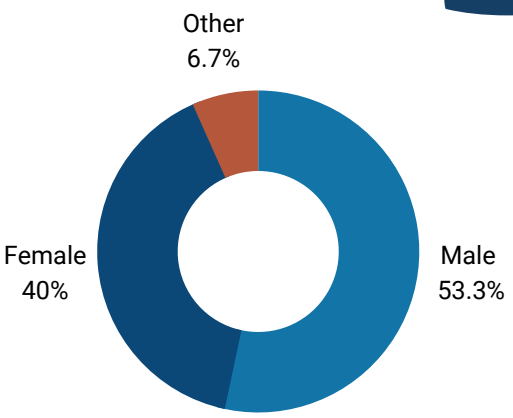
Technology Recommendations:

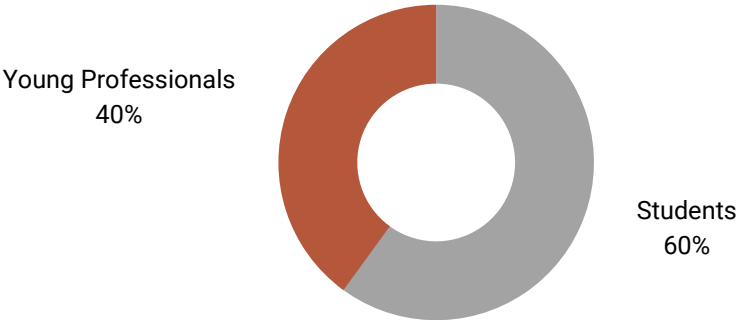
1. Early technology development should focus on cost reduction of existing services (e.g. making water utilities cheaper, improving existing traffic management to reduce congestion) rather than adding brand new services:
    - Improved alternative transport technologies (e.g. batteries, drones, etc.)
    - Cost reduction of satellite internet
    - Taking advantage of ai/automation + satellite imagery to minimize waste and labour (both in transportation + in production/waste management)

2. Develop technologies for non-urban communities first to naturally grow your user base and service (e.g. Starlink):
    - Take advantage of leap-frogging to avoid building brand new land infrastructure (e.g. go to satellite internet/mobile vs. landline)

Statistics

15 Delegates
10 Nationalities





Breakout Session 10: SGAC Policy Task Force (Virtual)

Engaging non-traditional backgrounds in space policy

Supported by:

The U.S. Task Force is excited to organize a breakout session that asks delegates to develop concrete recommendations for engaging more people and communities with space policy. Policy decisions impact everyone, so how can we make sure everyone has a seat at the decision-making table? Possible discussion topics include: how to engage more people from non-policy backgrounds in policy discussions, how to effectively communicate with and educate different audiences on relevant policy topics, how to develop international conversations and collaborations, and more.
Representatives from the U.S. Task Force will briefly present their strategies for sharing the young generation's perspectives on space policy, but the majority of the breakout session will be used for delegates to ask questions and develop their own ideas. Ideas developed in this breakout session will be compiled and posted on the U.S. Task Force website, they will be used to develop new initiatives within the Task Force, and they may even be shared with policymakers. Delegates interested in remaining involved with these initiatives and the U.S. Task Force after SGFF will be encouraged to do so.

Main Objectives

1. Ideas developed in this breakout session will be compiled and posted on the U.S. Task Force website, and media, and may even be shared with policymakers
2. To develop new initiatives within the Task Force
3. Delegates interested in remaining involved with these initiatives and the U.S. Task Force after SGFF will be encouraged to do so

Subject Matter Experts

Lindsey Wiser | Deputy Lead of the US Task Force ; PhD Student | SGAPP US Task Force ; Arizona State University

Moderator & Rapporteur

Sunny Narayanan | Programs & Outreach Co-lead of the US Task Force ; Research Professor | SGAPP US Task Force ; Florida State University

Moderator & Rapporteur

Questions

1. How do we engage more people from non-policy backgrounds in policy discussions?
2. How do we effectively communicate with and educate different audiences on relevant policy topics?
3. How do we develop international conversations and collaborations?

Answers

Representation makes a difference in policy decisions. Policy impacts everyone, and policy can also help to bring more people in. We talked about ways to encourage gender parity and engagement of marginalized communities, such as indigenous communities, through concrete initiatives.

Recommendations

Conclusions/Recommendation #1: We emphasized the importance of using accessible language! And suggest SGAC/the Task Force create a definitions guide to inform clear communication.

Conclusions/Recommendation #2: We talked about the creation of public outreach initiatives highlighting policy topics and lesser-known challenges in space, rather than just the standard “astronaut” talk. This increases transparency and raises awareness of the issues.

Conclusions/Recommendation #3: Related, we also talked about Highlighting lesser-known careers in space through interviews with SGAC members. There are many of us interested in space who may not want to be astronauts or engineers, so it is important to share different opportunities and perspectives.

Conclusions/Recommendation #4: We chatted about suggestions for ways to educate more WITHIN the space community on policy, such as sharing case studies and resources for startups and emerging space nations to help limit their hitting policy and bureaucracy roadblocks.

Conclusions/Recommendation #5: UN Space4Women has potentially been lacking funding/support. SGAC could leverage SGAC's broad network to contribute to or help with this initiative.

Conclusions/Recommendation #6: Develop more current media engagement - TikTok, etc

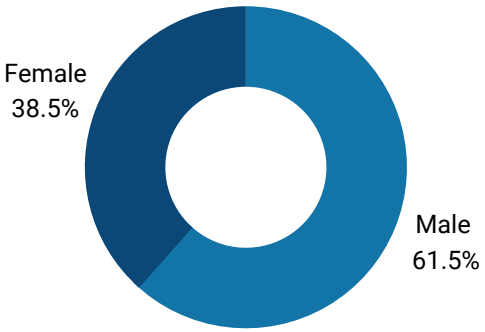
Conclusions/Recommendation #7: Create a document highlighting how space impacts the day-to-day and post that widely through SGAC/Task Force

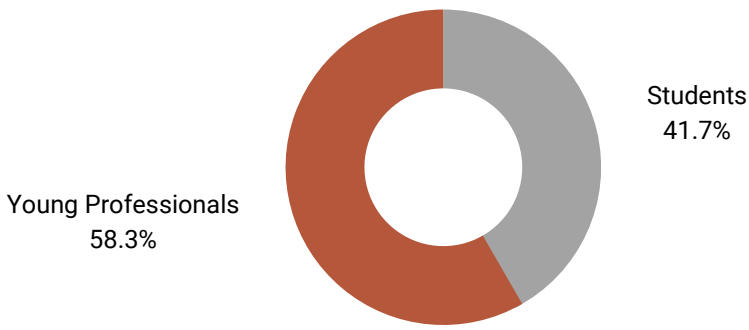
Conclusions/Recommendation #8: Produce info/resources targeted at kids. SGAC groups could partner with classrooms and teachers to organize lessons and activities.

Conclusions/Recommendation #9: Produce resources targeted at indigenous communities and other groups. Think about how space policy topics may impact these communities and how to bring them into the conversation.

Statistics

13 Delegates
8 Nationalities





Breakout Session 11: AAS (VIRTUAL)

The Effects of Small Satellite Constellations on Ground Based Astronomy

Mega small satellite constellations will create global accessibility to wifi at all times, however, they also have already caused a huge impact on the observational astronomy community. Now with only the initial thousands of satellites launched into LEO by Starlink, scientific data from the ground is covered with massive, bright streaks. This makes observational data worthless.
This group tackled the challenge of balancing the global need for wifi accessibility with the persistent need for astronomers to observe the nighttime sky. This breakout session focused on policy recommendations for the global space industry. This session received thorough background on the policy hurdles thus far, the technological advancements the astronomy community made over the last two years, and insights from the indigenous communities affected by an ever-growing small satellite business.

Main Objectives

1. Designate institutions or other collaborations astronomers can make across the globe to elevate their problem
2. Discuss the correlations with orbital debris mitigation and whether that can apply to ground-based observations
3. Provide recommendations to international bodies for how and why to mitigate the brightness of mega satellite constellations

Subject Matter Experts

Jessica Heim | American Astronomical Society's Light Pollution, Radio Interference and Space Debris (LPRISD) committee. | Dark Sky Initiatives in Central Idaho

Therese Jones | Senior Director of Policy | Satellite Industry Association

John Barentine | Principal Consultant | Dark Sky Consulting

Maurizio Vanotti | VP of Space Infrastructure Development & Partnerships | OneWeb

Charles Mudd | Principal Attorney | Mudd Law

Kristin Shahady | Systems Engineer and Masters Student | Ball Aerospace and The University of North Dakota

Moderator

Bram De Winter | Student | Vrije Universiteit Amsterdam

Rapporteur

Sarah Cader | Student | Osmania University

Rapporteur

Questions

1. Given the low likelihood of binding international guidelines in the immediate future on satellite brightness mitigation, what international institutions, collaborations, or other partnerships should we leverage to work on this problem?
2. What other fields have encountered “tragedy of the commons” problems on a global level, and have they found any successful mechanisms for mitigating the negative externalities that might be useful in this context?
3. Are there any disruptive actions you think an individual/company/government might take that could influence the trajectory of this problem, either positively or negatively?
4. How can the long-term sustainability of the space environment and the issue of aggregate impacts of space activities be incorporated into the business models and operations of the space industry?

5. If domestic regulation will be the most immediate (in relative terms) government oversight of the satellite industry's growth, how do we facilitate as much consistency as possible between efforts among diverse nations?
6. How do we persuade non-space-faring nations that efforts to regulate space do not come from a perspective of ensuring exclusivity of space or creating bars to entry into space-faring status?
7. How can the voices of more diverse stakeholders (such as Indigenous nations, those concerned about space industry impacts on the environment and the night sky, etc.) be more effectively heard and taken seriously by space actors (both industry and nations/related agencies)? What would be some concrete ways to help facilitate meaningful change in this area?

Answers

1. The disconnect between the astronomy community and satellite companies can be solved by targeting 3 major groups with the support of international organizations (IAF etc.): 1) the investors that are funding satellite companies, 2) Governmental institutions, and 3) Satellite companies. From a short-term perspective, international organizations are needed to get momentum for this particular problem and have conversations between satellite companies and the astronomy community. From a long-term perspective, governmental institutions are necessary to implement satellite incentives and boundary rules for the space industry.

2. The disconnect between the astronomy community and satellite companies can be solved by targeting 3 major groups with the support of international organizations (IAF etc.): 1) the investors that are funding satellite companies, 2) Governmental institutions, and 3) Satellite companies. From a short-term perspective, international organizations are needed to get momentum for this particular problem and have conversations between satellite companies and the astronomy community. From a long-term perspective, governmental institutions are necessary to implement satellite incentives and boundary rules for the space industry.

3. With international governance, as needed to imply rules that would benefit the astronomy community, the risk is highly likely that uneven competition will arise between countries that sign international treaties and countries that deny these treaties. Additionally, the satellite sector is a growing sector that is booming. Trying to reach both major as well as minor companies for governance would be an enormous challenge.
To reach the satellite sector, positive incentives are needed to impact investors and satellite companies. This needs to be done with international cooperation to ensure that satellite companies globally will have equal competition. Although this is a major issue in the current political environment, international organizations like IAF need to be aware of these problems. Another valuable option is in standardization on the scale of the astronomical community as well as testing satellite constellations prior to launching in governmental organized testing facilities. For the astronomical community standardization is needed to stress the importance of the effect of satellites on astronomy data loss.

Recommendations

Question 1

Conclusions/Recommendation #1: The breakout session wants to start an SGAC working group or task force with experts from the new IAU Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference.
The satellite industry including mega satellite constellation companies the IAF, National Space Agencies, and have a permanent presence/invitation to events hosted by the IAU centre.
The key here was to have stakeholders from both sides of astronomy and the satellite sector gain momentum and emphasize the importance of this problem towards the satellite sector as well as determine the impact on astronomy (optical, IR, radio) and how this impact could be mitigated by cooperation between different stakeholders.

Question 2

Conclusions/Recommendation #1: For stakeholders in the satellite industry, the group recommends:
Spacecraft reflected brightness should be limited to above the 7th magnitude wherever possible (and to be more strict for larger constellations). Testing and characterisation both on the ground and on orbit of spacecraft should be supported (subsidised/standardised) at a national level.

Question 3

Conclusions/Recommendation #1: For stakeholders in the satellite industry, the group recommends:
International funding of low-reflectance material science for satellites. This includes Engineering design requirements needed to work with the astronomy community for material science for the lowest possible reflectance on satellites, communications modifications and increased funding for additional testing facilities.

Question 4

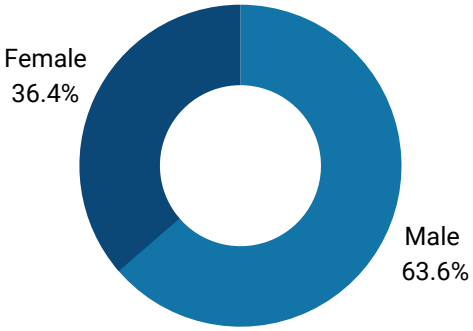
Conclusions/Recommendation #1: Satellite Operations Requirements:
Satellites can have astronomy-safe modes (Eg: shut down communications, change angle to reduce reflectance)
Satellite operators can share TLE actively to help the astronomy community coordinate observations

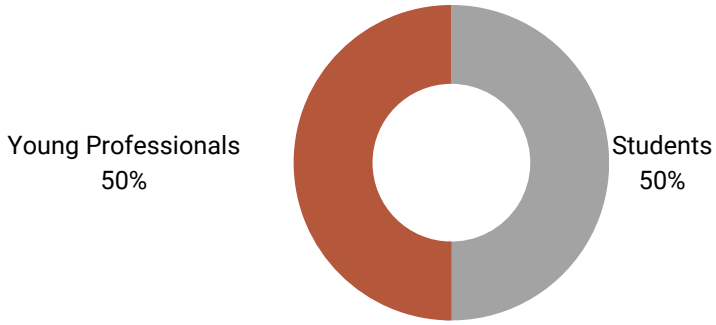
Question 5

Conclusions/Recommendation #1: The final, general recommendation is:
A strong recommendation for collaboration between the astronomy community and space sustainability community to study whether they can decrease the amount of satellites or adjust the size needed to perform global connectivity. The SGAC working group hopes to be the first bridge for this gap.

Statistics

13 Delegates
6 Nationalities

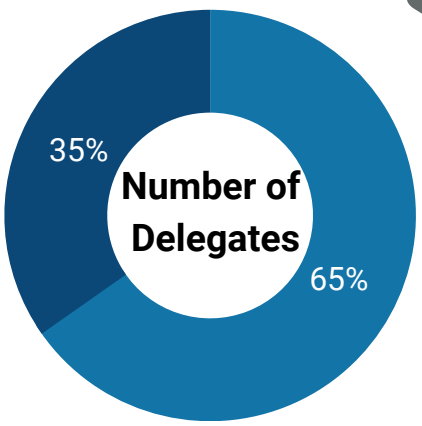




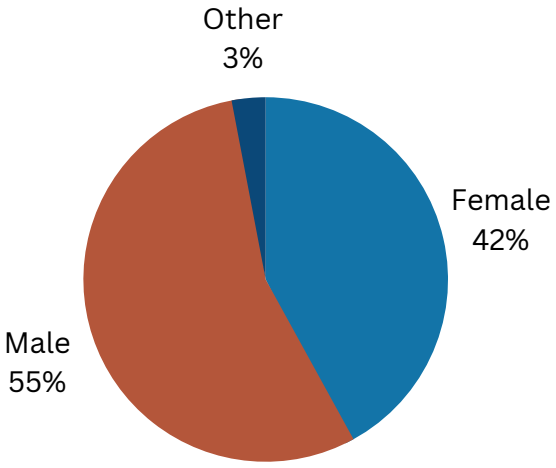
Event Statistics

20 Nationalities

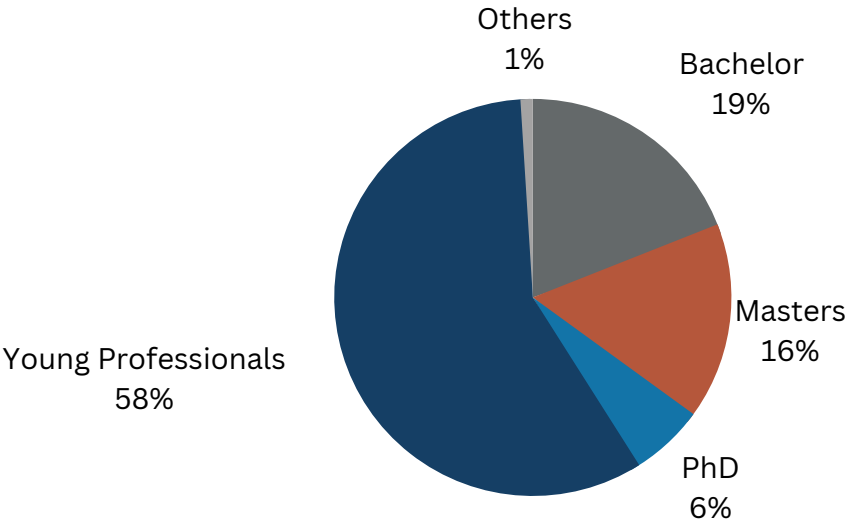
11 Breakout Sessions



	In-person	77
	Virtual	41
	Total	**118 Delegates**



GENDER DISTRIBUTION



ACADEMIC BACKGROUND OF PARTICIPANTS

Speakers and Panelists

Tony Antonelli
NASA

Tony Antonelli holds Aeronautical and Astronautical degrees from MIT and the University of Washington. As a Naval Aviator and Test Pilot, he had over 4,700 hours in more than 40 different types of aircraft; including 273 carrier arrested landings (traps). He is a former NASA Astronaut with technical assignments in Space Shuttle Propulsion, CAPCOM and Commercial Crew, and additionally who flew as the Pilot for STS-119 and 132 on Space Shuttles Discovery and Atlantis. He is a Lockheed Martin Executive leading teams in Advanced Programs and most recently the Orion Spacecraft for the Artemis II Mission.

Steve Eisenhart
Space Foundation

As head of international affairs, Steve Eisenhart is principally responsible for the Space Foundation's global strategy and relationships with international space agencies and organizations, foreign embassies and U.S. organizations involved with global space programs. He is directly responsible for the program development and integration of key Space Foundation activities including the annual Space Symposium. He also supervises the Space Foundation's government affairs activities in the Washington, D.C., office including relationships with government agencies, other space advocacy organizations and associations and corporate interests. Since joining the Space Foundation in 1996, Eisenhart has had a broad range of responsibilities, serving as senior vice president of strategic communications, director of communications and public affairs and communications manager. Eisenhart was a military public affairs officer and is a graduate of the United States Military Academy at West Point.

Brig. Gen. Michael Adamson
Royal Canadian Air Force

Brigadier-General Michael Adamson assumed the role of RCAF Director General Space and the Joint Force Space Component Commander in June 2020. As Director of General Space, he oversees the administrative functions of the Space enterprise for the CAF. This includes the generation and development of personnel and strategic engagements. As Joint Force Space Component Commander, he is responsible for the delivery and use of space capabilities (force employment) and personnel who work in the Canadian Space Operations Centre (CANSpOC) to enable operations.

Dr. Amy Lo
Northrop Grumman

Amy Lo is the Deputy Director for the Vehicle Engineering IPT of the James Webb Space Telescope. She is responsible for execution in support of the Space Vehicle Director for cost, schedule and management of all Space Vehicle elements, as well as ensuring technical execution and process compliance for all Vehicle Engineering disciplines supporting the Webb program. Prior to this role, Lo served as the Alignments Thread Lead for Webb, responsible for all aspects of mechanical alignments for the Observatory.

Lo joined Northrop Grumman in 2005 and has been involved in a variety of optical design and simulation projects with large deployables. Her expertise includes mathematical simulations, mission architecture development, mission analysis and system engineering. Prior roles include Mission Performance Thread Lead for the Next Generation Polar program and system engineering for the CERES program.

Lo earned her bachelor's degree in Physics at Brown University and her Ph.D. in Astrophysics from UCLA. Lo is a member of the American Astronomical Society, the Institute of Electrical and Electronics Engineers and the American Institute of Aeronautics and Astronautics. She has more than 30 technical publications in the subjects of Astrophysics and Exoplanet Detection Technology.

Lauren Lyons

Lauren previously served as the Chief Operating Officer of Firefly Aerospace, the Lead Systems Engineer for Blue Origin's Orbital Reef, and led the Requirements, Verification, Validation, and Certification team for the Blue Origin-led Artemis Human Landing System National Team. Before joining Blue, she was a senior engineer at SpaceX working on Falcon 9, Starlink, Cargo Dragon, and Crew Dragon, including launch webcasts for including the Emmy Award-winning Demo 1. Before joining the world of commercial space, Lauren was a medical device R&D engineer, worked on Mars robots at NASA/JPL, wrote about how space benefits Earth, and taught leadership courses at Harvard University. Lauren has a bachelor's degree in Mechanical and Aerospace Engineering and minors/certificates in Engineering Biology and Robotics & Intelligent Systems from Princeton University, alongside a master's degree in Business and Government Policy from the Harvard John F. Kennedy School of Government.

Bhavya Lal
NASA

As the Associate Administrator for Technology, Policy and Strategy within the Office of the NASA Administrator, Bhavya Lal is responsible for providing evidence-driven advice to NASA leadership on internal and external policy issues, strategic planning, and technology investments. She is also the Acting Chief Technologist of NASA, the first woman to hold the position in NASA's 60+ year history.

Prior to her current role and in the first 100 days of the Biden Administration, she was the Acting Chief of Staff at NASA and directed the agency's transition under the administration of President Biden. Before arriving at NASA, she had served as a member of the Presidential Transition Agency Review Teams for both NASA and the Department of Defense. For 15 years prior to that, Dr. Lal led strategy, technology assessment, and policy studies and analyses at the Institute for Defense Analyses (IDA) Science and Technology Policy Institute (STPI) for government sponsors including the White House Office of Science and Technology Policy (OSTP), the National Space Council, NASA, Department of Defense, and other Federal Departments and Agencies.

Dr. Lal holds bachelor's and master's degrees in nuclear engineering from the Massachusetts Institute of Technology (MIT), a second master's from MIT's Technology and Policy Program, and a PhD in Public Policy and Public Administration from George Washington University.

Dr. Katherine Calvin
NASA

Cassie Kloberdanz Lee leads Climate Intelligence at Lockheed Martin where she is responsible for applying existing and emerging technologies to better understand and preserve our changing planet. She has also served as the Principal Investigator for Lockheed Martin's next generation of climate, weather and Earth science instruments and satellite systems.

Lee is a graduate of the University of Colorado Boulder, where she designed and taught a graduate course in Aerospace Engineering Sciences and the University of Iowa. She began her career as a propulsion engineer for NASA, has held a variety of roles in human spaceflight and business development with Sierra Nevada Corporation, and led media and public relations at SpaceX.

Michael Edmonds
Blue Origin

Senior Vice President, Strategy, Marketing, Sales

Jo-Anne Sears is a master communicator at the highest levels of policymaking in Washington. She wields her subject matter expertise and access to decision-makers on behalf of Velocity's aerospace/defence, intelligence, and space tech clients to influence laws and regulations and conduct successful business development with federal agencies.

Jo-Anne Sears
Velocity Government Relations

Jo-Anne's strategic instincts developed over 20+ years as a trusted communications and public affairs advisor in the national security community. She crafted effective policy messaging and crisis communications for the White House, Secretary of State, Secretary of the Air Force, real-world intelligence and military operations, and entrepreneurial defence and space tech companies, among others.

Jo-Anne holds an M.A. in Organizational Change Management, with Distinction, from Hawaii Pacific University and a B.A. in Communications and English, Cum Laude, from Marist College. Her upbringing in a military family instilled in Jo-Anne the importance of public service. She is a member of the Intelligence and National Security, Women in Aerospace, and a colonel in the Honorable Order of Kentucky Colonels Inc., the highest title of honour bestowed by the Governor of Kentucky in recognition of an individual's outstanding service to the community, state, and nation.

Lauren Smith is a program manager for the Satellite Servicing operating unit within the Tactical Space Systems division of Northrop Grumman Space Systems. In this role, Smith leads multiple programs that advance the future of on-orbit refuelling.

Lauren Smith
Northrop Grumman

Smith has served in multiple, diverse air and space roles across her career at Northrop Grumman, from mechanical test engineering manager for the James Webb Space Telescope (JWST) to operations management for the Ground Enterprise Systems Operating Uniand. As a program manager in Resilience and Rapid Prototyping, NG Next, and Advanced Unmanned Systems, Smith has executed numerous programs and contributed to several strategic captures.

Previous to joining Northrop Grumman, Smith worked at NASA Glenn Research Center in the Simulated Lunar Operations Lab. She also conducted her thesis work at Glenn, specializing in mechanisms and robotics. This work contributed to being named one of Aviation Week's Twenty20s.

Smith holds a bachelor's degree in aerospace engineering, bachelor's and master's degrees in mechanical engineering, and a minor in political science from Case Western Reserve University.

Debra Facktor
Airbus U.S.

Debra Facktor is the Head of U.S. Space Systems for Airbus U.S. Space & Defense, Inc. As such, she is responsible for managing the two businesses within U.S. Space Systems: National Security Space and Space Exploration. Debra is also on the board of Airbus OneWeb Satellites, a joint venture operating a state-of-the-art satellite manufacturing facility.

Prior to joining Airbus U.S., Debra was Vice President and General Manager of Strategic Operations for Ball Aerospace, leading the company's Washington DC operations, strategic development, and marketing and communications. Her extensive business experience includes serving as President and Owner of AirLaunch LLC, and as Vice President of Business Development and Strategic Planning for Kistler Aerospace Corporation.

Debra is actively engaged as an advisor and mentor in the aerospace community and is a fellow of the American Institute of Aeronautics and Astronautics (AIAA) and the American Astronautical Society (AAS).

Debra received her bachelor's and master's degrees in aerospace engineering from the University of Michigan and is an alumna of the International Space University summer session program in Strasbourg, France.

Dr. Paul Bate
United Kingdom Space Agency

Dr. Paul Bate has been CEO of the UK Space Agency, an Executive Agency of the Department for Business, Energy and Industrial Strategy (BEIS), since September 2021.

Prior to this, Paul was Vice President, Commercial at Babylon Health, working with healthcare organizations in the NHS and across the world. Before that, he was the Executive Director of Strategy and Intelligence at the Care Quality Commission. As a civil servant, he was the policy adviser for health and adult care for the Prime Minister and Deputy Prime Minister from 2011 – 2013. Paul has a PhD in Particle Physics.

The UK Space Agency's Chief Executive leads a team of more than 250 who provide technical advice on the government's space strategy and guide the UK space sector to deliver the government's vision. The UK Space Agency designs and delivers programmes that implement the government's strategy, including as a sponsor of national capabilities and an early-stage investor in space research and development. They promote the UK space sector's interests and achievements, make connections to join up industry and academia, and represent the UK in international space programmes.

Cassie Kloberdanz Lee leads Climate Intelligence at Lockheed Martin where she is responsible for applying existing and emerging technologies to better understand and preserve our changing planet. She has also served as the Principal Investigator for Lockheed Martin's next generation of climate, weather and Earth science instruments and satellite systems. Additionally, Lee is Chair of the Board of Directors for PLACE, a non-profit technology organization and data trust established to help improve lives, strengthen public services, and better care for the environment. She also serves as a Strategic Advisor to Bye Aerospace, a world leader and innovator of electric and solar-electric aircraft.

Cassie Lee
Lockheed Martin

Lee is the co-founder of the Brooke Owens Fellowship, a program designed to elevate extraordinary undergraduate women and gender minorities in aerospace. This award-winning Fellowship model has two spin-off programs in the United States and one in Canada. She is a founding member of the United Nations Office for Outer Space Affairs (UNOOSA) Space4Women Network, serving as a Mentor and as part of the cohort of space industry leaders committed to promoting gender equality and empowerment for women and girls in the space sector around the world.

Lee is a graduate of the University of Colorado Boulder, where she designed and taught a graduate course in Aerospace Engineering Sciences and the University of Iowa. She began her career as a propulsion engineer for NASA, has held a variety of roles in human spaceflight and business development with Sierra Nevada Corporation, and led media and public relations at SpaceX.

General Manager

Jean Michael
Aerospace Corporation

Davide Petrillo
Space Generation Advisory Council

Davide Petrillo is the Executive Director of the Space Generation Advisory Council (SGAC). Davide holds an M.Sc. in Aerospace Engineering from the University of Padova (Italy). His professional experience brought him to London (UK) as a Business Manager for Alten Ltd and previously in Milano (Italy) as a Business Analyst for Accenture, a global management consulting company that provides strategy, consulting, technology and operations services. Previously, he was the Team Leader of the FELDs Experiment selected by the European Space Agency (ESA) for the Drop Your Thesis! 2014 programme. FELDs tested a tethered electromagnetic soft docking technology in microgravity conditions at the Drop Tower of the Centre of Applied Space Technology and Microgravity (ZARM) in Bremen, Germany. In 2015, he won the IAF "Hans Von Muldau Team Award" for the best team project that took place in Jerusalem at the 66th International Astronautical Congress (IAC). Moreover, since October 2021, Davide has been elected as Vice President for Education and Workforce Development of the International Astronautical Federation (IAF).

Madeline Cowell
Ball Aerospace

Madeline (Maddie) Cowell is an optical engineer in the Civil Space business unit at Ball Aerospace. In this role, she leverages her past experience from a life in data and applies it to research and hardware. Cowell has 10 years of experience in data discovery and statistical modelling across various settings that include business analytics, geo-intelligence and engineering analysis. She has used satellite data to inform reports on point targets, broad area analysis, and long-term trending studies.

Cowell is currently the principal investigator (PI) for a NASA-funded grant through the Earth Science Technology Office (ESTO) to investigate plastic signatures for remote sensing. She also supports the operation, calibration and data processing for airborne initiatives such as the Sustained Land Imaging Technology (SLI-T), funded by ESTO.

Cowell received a B.S. in optical engineering from the University of Arizona. She also received a M.S. in applied mathematics and statistics from the Colorado School of Mines.

Laura Means
NASA

Strategic Communications for NASA's Human Landing System

Jena Garrahy
NASA

Jena L. Garrahy is the Network Integrity Manager for the Space Communications and Navigation (SCaN) Program at NASA Headquarters. She develops and oversees the implementation and application of National Security policies and NASA Cyber and Physical Security Directives for all space and ground network infrastructure in NASA including the Near Space Network and the Deep Space Network. These mission-critical network resources facilitate the return of exploration and science data from near-Earth space and the far reaches of the solar system and ensure that mission operators can safely operate spacecraft and support our human explorers.

For several years, Ms Garrahy has been a leader within the security community, most recently with NASA, but her experience also includes several Department of Defense agencies and the Federal Aviation Administration. Prior to working for the federal government, she managed the Information, Physical, Personnel and Industrial security programs to protect and safeguard Classified National Security Information (CNSI) for a $120 million per year NASA contract. In this role, she also managed cleared and un-cleared employees and consultants operating at twelve different locations around the world.

Originally from New York State, Ms Garrahy earned her Bachelor's Degree from Plattsburgh State University in Upstate NY. She obtained her Master's Degree in International Business and Statistics from Bond University on the Gold Coast of Australia. She earned a second Master's Degree from George Washington University in National Security and Safety Leadership.

Vice President of Business Development, Earth Intelligence

Jeff Rex
Spire

Brian Weeden
Secure World Foundation

Dr. Brian Weeden is the Director of Program Planning for Secure World Foundation and has more than 20 years of professional experience in space operations and policy.

Dr. Weeden directs strategic planning for future-year projects to meet the Foundation's goals and objectives and conducts research on space sustainability issues. He is a member and former Chair of the World Economic Forum's Council on the Future of Space Technologies, a former member of the Advisory Committee on Commercial Remote Sensing (ACCRES) to the National Oceanic and Atmospheric Administration (NOAA), and the current Executive Director of the Consortium for Execution of Rendezvous and Servicing Operations (CONFERS). Prior to joining SWF, Dr. Weeden served nine years on active duty as an officer in the United States Air Force working in space and intercontinental ballistic missile (ICBM) operations.

Dr Weeden holds a Bachelor's Degree in Electrical Engineering from Clarkson University, a Master's Degree in Space Studies from the University of North Dakota, and a PhD in Public Policy and Public Administration from George Washington University in the field of Science and Technology Policy.

Maj. Gen. DeAnna M. Burt
United States Space Force

Maj. Gen. DeAnna M. Burt is the Commander, Combined Force Space Component Command, U.S. Space Command, and Vice Commander, Space Operations Command, U.S. Space Force, Vandenberg Space Force Base, California. As Commander of U.S. Space Command's Combined Force Space Component Command, she leads more than 17,000 joint and combined personnel with a mission to plan, integrate, conduct, and assess global space operations to deliver combat-relevant space capabilities to combatant commanders, coalition partners, the joint force, and the nation. Maj. Gen. Burt plans and executes space operations through four distinct and geographically dispersed operations centers.

Maj. Gen. Burt entered the Air Force in 1991 as a distinguished graduate of the Air Force ROTC program at Embry-Riddle Aeronautical University. Her career has included numerous satellite operations and staff positions in Air Force Space Command and U.S. European Command. Maj. Gen. Burt has commanded the 2nd Space Operations Squadron, the 460th Operations Group and the 50th Space Wing.

She is a graduate and former instructor of the U.S. Air Force Weapons School and a graduate of the School of Advanced Air and Space Studies.

Air Vice-Marshall Paul Godfrey
Royal Air Force

Paul joined the Royal Air Force in 1991 and has been a fighter pilot for most of his career. A weapons instructor on the Harrier and one of the first operational pilots on the Eurofighter Typhoon, he has flown on numerous operations and exercises with the RAF and undertook an exchange tour on the F-16 Fighting Falcon with the United States Air Force. He was also privileged to be a Spitfire and Hurricane pilot on the Battle of Britain Memorial Flight.

Other roles have included Typhoon requirements management at Defence Equipment and Support in Bristol, capability management at the Ministry of Defence and operational programme management within the F-35 Lightning programme.

Between 2015 and 2017, Paul was Station Commander of RAF Lossiemouth in Scotland before moving to the Ministry of Defence as head of Carrier Enabled Power Projection, integrating F-35B fighters and Crowsnest helicopters with Queen Elizabeth class aircraft carriers. He recently returned from Al Udeid airbase in Qatar, where he was responsible for the planning and employment of coalition air and space power across the Middle East within the USAF Combined Air and Space Operations Centre. He was announced as the inaugural Commander of UK Space Command in Feb 2021.

Rowan Palmer
Lockheed Martin

Rowan Palmer is a Systems Engineer for Human Space Exploration within Lockheed Martin Space's Advanced Programs (AP). Much of her work is a systems engineering and structural design & testing for softgoods habitats, like those central to Starlab, a commercial space station and science park. She also supports the In-Situ Resource Utilization (ISRU) team and AP Architectures team in the definition of space exploration ecosystems and the development of lunar water economy technologies. Rowan is passionate about the intersection of people and technology and is currently leading the Starlab initiative to research and implement disability-accessible design.

Rowan is a 2020 Brooke Owens Fellow. STEM empowerment and education, especially for women in STEM, is a core driver of her work, which she pursues by volunteering and mentoring with various organizations. She graduated cum laude from Yale University in 2021 with a degree in Mechanical Engineering; her senior thesis project focused on researching and prototyping inexpensive, detachable devices to improve mobility for wheelchair users in inaccessible environments. She has previously worked at Oak Ridge National Laboratory's Manufacturing Demonstration Facility researching large-scale additive manufacturing, and at Stanley Black & Decker doing product development.

Robbie Schingler
Planet

Robbie Schingler is the Co-Founder and Chief Strategy Officer (CSO) of Planet Labs PBC. Robbie has committed his life to preserving the sustainability of Earth and the security of human life across the globe. As CSO of Planet, Robbie was integral to establishing Planet as a publicly traded Public Benefit Corporation in December 2021 ($PL). He leads the company's long-term strategic trajectory, including mergers and technology partnerships, spearheading Planet's acquisitions of VanderSat in 2021, Boundless in 2019, and BlackBridge in 2015. Robbie also manages the Space Systems Division, supporting the development of space technologies and mission operations. Previously, he was Managing Director of Planet Europe from 2016-2017 and currently serves on the Board of both Planet PBC and Planet Federal.

Prior to Planet, Robbie spent 9 years at NASA, where he helped build the Small Spacecraft Office at NASA Ames and acted as Chief of Staff for the Office of the Chief Technologies at NASA Headquarters.

Robbie received an MBA from Georgetown University, focusing on social entrepreneurship and international business. He also spent a year at the International Space University in Strasbourg, France receiving an MS in Space Studies, concentrating on spacecraft cooperation for education and science, and he received his BS in Engineering Physics from Santa Clara University.

Bryn Orth-Lashley
GHGSat

Bryn Orth-Lashley is the Team Lead for Satellite Operations and Service Delivery at GHGSAT, an innovative Canadian company that is pioneering space technology to remotely monitor greenhouse gasses and provide emissions data and intelligence to businesses, governments, regulators, and investors worldwide to enable emission reduction goals and fight climate change. He has a passion for enabling new applications of space technologies for the betterment of society, applying this passion to previous positions at QinetiQ and most recently MDA, where he was the Mission Systems Engineer and Commissioning Coordinator for the RADARSAT Constellation Mission. He also serves as one of the Space Generation Advisory Council National Points of Contact for Canada.

He received his BSc and MSc in Astrophysics from the University of Toronto and an MSc in Space Science and Engineering from University College London.

BreeAnn Edris
Lockheed Martin

BreeAnn Edris currently serves as the Business Development Lead for Lockheed Martin's space habitation programs. In this role, she oversees the strategy and new business capture for various orbital, surface, and transport spacecraft for low earth orbit and future expeditions to the Moon and Mars. Previously, she led Lockheed's Commercial LEO Destinations Free Flyer proposal effort resulting in the Starlab team's $160M award and was also a member of the National Team's Human Landing System program leading the Mission Operations demonstration which integrated crew procedures and flight software. During her 20-year tenure at Lockheed, she has also served as a software developer, worked program startup activities for the Orion Production Operations Contract, provided Atlas launch and marketing support, and led planning efforts for several large-scale customer events. She holds a bachelor's degree in Business Administration with a concentration in Computer Information Systems from Colorado State University.

Eric Ingram
Scout Inc.

Eric Ingram is the Founder and CEO of SCOUT Inc., a US-based company developing orbital products and services to enable a new era of space safety and transparency. He is also a Board Member of the Space Frontier Foundation and is an Organizing Team Member & Ambassador for Mission: AstroAccess. Previous to SCOUT, Eric served as an Aerospace Engineer for the Licensing and Evaluation Division of the FAA's Office of Commercial Space Transportation, where he gained valuable expertise in the regulatory environment of commercial spaceflight. Prior to this, he worked as an Engineer for Deep Space Industries' Special Projects Division, where he designed cubesat subsystems for testbed missions.

Eric holds a Bachelor of Science in Physics from Old Dominion University, most of a Master of Science in Electrical Engineering from the University of Houston, a sport pilot certificate, and is working towards his SCUBA certification. Outside of the space industry, Eric proudly served as the President of the United States Wheelchair Rugby Association from 2016 to 2020, leading the USWRA to its largest budget surplus in its 30+ year history. Eric has competed in the sport of wheelchair rugby for 15+ years, competing domestically for several club teams, and internationally with the US Developmental team.

Anna Voelker
SciAccess

Anna Voelker (they/them) is the founder and Executive Director of the SciAccess, an international nonprofit that promotes disability inclusion in STEM education, outreach, and research. Through SciAccess, Anna leads numerous science accessibility programs, including Mission: AstroAccess, which is dedicated to advancing disability inclusion in space exploration. On October 17, 2021, Mission: AstroAccess flew its inaugural crew of disability ambassadors on a parabolic flight with the Zero Gravity Corporation as a first step towards investigating accessibility in microgravity environments. AstroAccess is planning to conduct its second parabolic flight this year and aims to pave the way for astronauts with disabilities to live, work, and thrive in space.
Anna specializes in accessible science outreach for diverse audiences and is passionate about making STEAM (science, technology, engineering, arts, and mathematics) accessible to all, as detailed in their 2017 TEDx Talk. In May 2021, Anna hosted a live NASA event where astronauts on the International Space Station (ISS) answered questions from students with disabilities. This was the first ISS event to feature American Sign Language in over a decade. Anna was named a 2018 Brooke Owens Fellow, 2021 Future Space Leader, and previously worked at NASA Kennedy, NASA Goddard, the Space Telescope Science Institute, the Ohio State University Department of Astronomy, and the Aerospace Corporation.

Dr. Erika Wagner
Blue Origin

Dr. Erika Wagner serves as Payload Sales Director for Blue Origin. Prior to joining Blue Origin, Dr. Wagner worked with the X PRIZE Foundation as Senior Director of Exploration PRIZE Development and was the founding Executive Director of the X PRIZE Lab at MIT. Previously, she served as the MIT Science Director of the Mars Gravity Biosatellite Program. Erika has also served as a member of the Commercial Spaceflight Federation's Suborbital Applications Researchers Group, the Board of the American Society for Gravitational and Space Research and NASA's Planetary Protection Independent Review Board. She currently serves as a Trustee of the Museum of Flight as well as a member of the National Academies' Space Studies Board. Dr. Wagner holds a bachelor's degree in Biomedical Engineering from Vanderbilt University, a master's in Aeronautics and Astronautics from MIT, and a PhD in Bioastronautics from the Harvard/MIT Division of Health Sciences and Technology. She is also an alumna of the International Space University, Associate Fellow of the American Institute of Aeronautics and Astronautics, and member of the Space Camp Hall of Fame.

David Zuniga
Axiom Space

Mr. Zuniga is a business development manager for in-space manufacturing and research for Axiom Space and helps to develop strategy and growth around Axiom's LEO economy. He has over 20 years of experience in engineering, and business development in human spaceflight and the Department of defense. Mr. Zuniga has developed system architectures and technology for deep space systems via the constellation, Orion, and Gateway programs. He was a Certified Principal Engineer for Orion's Air Revitalization System, and subsystem manager for NASA's Gateway program for the Environmental Control and Life Support Systems (ECLSS) where he developed requirements and certification criteria for future architectures.

Mr. Zuniga has served in numerous committees around human spaceflight safety and commercialization, has been an invited speaker to brief NASA HQ on strategy for the ISS NL, and was the recipient of the top prize at NASA's Ignite the Night competition through NASA iTech when serving as the managing director for the Danish Aerospace Company's North American Division.

Mr. Zuniga earned Bachelor's and Master of Science degrees in Mechanical Engineering from Texas A&M University and holds a graduate certification in Space Resources from Colorado School of Mines where he studied space policy, economics, and space resource utilization.

Dr. Christian Feichtinger
International Astronautical Federation

Dr Feichtinger took up the post of IAF Executive Director on 1 January 2012.
Before moving to the IAF, Feichtinger, who comes from Austria, spent three years as a senior advisor on exploration at the European Space Agency (ESA). Prior to that, he was head of ESA's permanent mission in the Russian Federation, after having worked as the Agency's representative for human space flight and exploration in Moscow for 10 years.

Previous positions Feichtinger held include flight operations support manager for the Euro-Russian EUROMIR-94 and 95 missions at the Russian mission control centre near Moscow; liaison officer to Russian organisations within the EUROMIR-94 and 95 mission management teams at the ESTEC technical centre in the Netherlands; and technical manager of the Soviet-Austrian AUSTROMIR project and follow-on missions.

Feichtinger holds a PhD in space experimentation from Graz University of Technology, Austria.

Dr. Walther Pelzer
German Aerospace Center (DLR)

Walther Pelzer has been a Member of the DLR Executive Board since 1 January 2018. He is the Head of the German Space Agency at DLR, based in Bonn.

Born in 1967, Walther Pelzer studied mechanical engineering at RWTH Aachen University and went on to complete a doctorate on the topic of 'Methodology for Identifying and Exploiting Strategic Technology Potential' at the Fraunhofer Institute for Production Technology. From 1999 to 2002, Pelzer was responsible for a variety of tasks in the areas of investment and value-creation management, strategy and technology control for Degussa AG in Frankfurt am Main and Hanau, and Ferro Corporation in Washington (USA). He then completed a correspondence MBA in Zürich, St. Gallen and Bonn from 2005 to 2008.

Pelzer was head of the AVR GmbH project group from 2008, where he was responsible for dismantling and disposing of the AVR experimental reactor and its fuel elements. He was also appointed as the representative of the state government charged with returning the fuel elements to the USA. Pelzer was the Permanent Representative of the Head of the Department from 2015 onwards.

Walther Pelzer has held a variety of guest lectures and seminars at universities focusing on the issues of balanced scorecards, technology management, innovations based on technology platforms and working with subsidiaries in the USA.

John Conafay
Integrate Space

John Conafay previously led commercial Business Development for ABL Space Systems, signing multiple pre-launch contracts including for Amazon Kuiper's first satellites. Prior to ABL, Conafay was a Business Development Director at Spaceflight Inc. for rideshare aggregation and launch services through the company's purchase by Mitsui. Before Spaceflight, he was employee number six at Astranis Space Technologies, in Business Development at Bryce Space and Technology, and interned at Spire Global. A veteran of the United States Air Force, SGAC Alumni Treasurer, and SEDS Alum Executive Director.

Lisa Campbell
Canadian Space Agency

Before being appointed as President of the Canadian Space Agency, Lisa Campbell was Associate Deputy Minister, Veterans Affairs Canada, supporting the well-being of veterans and their families and promoting recognition of those who served Canada.

Previously, Ms. Campbell was Assistant Deputy Minister, Defence and Marine Procurement, leading the organization procuring Canada's military and marine equipment. She worked at Canada's competition authority as Senior Deputy Commissioner reviewing mergers and business conduct. Ms. Campbell also enforced civil and criminal laws for truth in advertising.

She has done extensive regulatory work on the collection and trade in data, particularly in emerging business models. Ms. Campbell worked as a litigator in the areas of criminal, employment and constitutional law. She holds a B.A. in political science from McGill University (1988) and an LL.B. from Dalhousie Law School (1991).

Enrico Palermo
Australian Space Agency

Enrico has led the Australian Space Agency since January 2021 from its headquarters in Adelaide. Since his commencement, Enrico has overseen a number of major milestones. Under his leadership, the Agency has reached an agreement with NASA for an Australian-designed, built and operated rover to be included in a future mission to the Moon. The first launch permit and launch facility license under the new Australian Space (Launches and Returns) Act have been issued, and there has been the first commercial launch attempt.

Before joining the Agency, Enrico spent 14 years in various roles at Virgin Galactic, including establishing and leading a vertically integrated aerospace manufacturing and testing operation of over 700 engineers, technicians and professionals responsible for the build and testing of a fleet of Mach 3, crewed commercial spaceships. From there Enrico was part of the team that launched the New York Stock Exchange-listed public company and was appointed Chief Operating Officer.

A Perth native, Enrico graduated from the University of Western Australia with a Bachelor of Engineering in Mechanical Engineering and a Bachelor of Science in Physics and Applied Mathematics. He also studied at the International Space University in Strasbourg. Enrico has worked and studied in the United States, United Kingdom, France and the Netherlands.

Chirag Parikh
The White House

Mr. Chirag Parikh was appointed as the Executive Secretary of the National Space Council on August 2, 2021. As Executive Secretary, Mr. Parikh is responsible for advising the President on domestic and international policy across the civil, commercial, and national security sectors; as well as monitoring the implementation of the President's space policy. He joined the Biden-Harris Administration from Microsoft Azure, where he led the company-wide initiative to bring together the power of global cloud capabilities with the evolving space industry.

Prior to his work in industry, Mr. Parikh had a U.S. government career that spanned more than two decades. From 2010-2016, Mr. Parikh served as the White House Director of Space Policy on the National Security Council. Prior to the White House, Mr. Parikh led the United States space intelligence community as the Deputy National Intelligence Officer for Science and Technology. Additionally, Mr. Parikh served as a Senior Executive at the National Geospatial-Intelligence Agency where he held a variety of roles including leading the collection and tasking of geospatial intelligence (GEOINT) sensors and the analysis of GEOINT data. Mr. Parikh began his career as an aerospace engineer at the National Air and Space Intelligence Center. He holds a B.S. in Aerospace Engineering from the University of Cincinnati

Kenneth Bowersox
NASA

Kenneth Bowersox is the deputy associate administrator for NASA's Space Operations Mission Directorate. Before being appointed to that position, Bowersox served as the Interim Chair of the NASA Advisory Council from June 2016 to January 2017. He is a retired U.S. Naval Aviator, with over 19 years of experience at the National Aeronautics and Space Administration (NASA). Selected to the astronaut corps in 1987, he has flown five times on NASA's Space Shuttle, serving as pilot, commander and mission specialist, and once on a Russian Soyuz, where he served as the flight engineer during descent. During his five orbital missions, Bowersox has logged over 211 days in space, including five and a half months aboard the International Space Station (ISS), where he was the mission commander of the 6th expedition. Subsequent to his mission aboard the ISS, Bowersox served as the director of the Johnson Space Center's Flight Crew Operations Directorate, retiring from NASA and the U.S. Navy in December 2006.

After retirement, he remained involved with the U.S. space exploration program as a member of the standing review boards for ISS, Space Shuttle, and the Constellation Program. Currently, Ken works as an independent technical consultant, advising clients on spacecraft design, and proposal development, and providing an independent assessment of technical programs. He joined the NASA Advisory Council in November 2013, and served as Chair of the Human Exploration and Operations Committee.

Dr. Joseph Aschbacher
European Space Agency

Born in Austria, Josef Aschbacher studied at the University of Innsbruck, graduating with a Master's and a Doctoral degree in natural sciences. He became a research scientist at the university's Institute of Meteorology and Geophysics from 1985 to 1989.

He began his career in ESA in 1990 as a Young Graduate at ESRIN. From 1991 to 1993 he was seconded as ESA Representative to Southeast Asia to the Asian Institute of Technology in Bangkok, Thailand, where he initiated major cooperation programmes between the EC, ESA and Southeast Asia.

In 2006 he became Head of the Copernicus Space Office, located at ESRIN where he led all activities for Copernicus within the agency and with external partners, in particular the European Commission, before being promoted to Head of Programme Planning and Coordination, where he was responsible for planning ESA's Earth Observation programmes and for formulating and implementing programmatic and strategic decisions across the Directorate.

In 2016, Josef Aschbacher was appointed as Director of Earth Observation Programmes, ESA's largest Directorate, and as Head of ESRIN, ESA's Centre for Earth Observation. Under his leadership, Europe developed the world's leading Earth observation programme, which includes all Sentinel missions as part of the EU-led Copernicus programme, all meteorological missions for Eumetsat and the Earth Explorer, Scout and phi-sat missions developed for ESA Member States. In 2020, a total of 40 satellites were under development and ESA disseminated the world's largest Earth observation data volumes.

Air Commodore Nicholas Hogan
Royal Australian Air Force

Event Host

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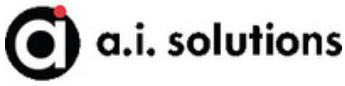
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