



19th Space Generation Congress

Mohammed Bin Rashid University of
Medicine and Health Sciences



SPACE GENERATION
ADVISORY COUNCIL



SPACE GENERATION
ADVISORY COUNCIL



Dubai, UAE | Hybrid 21st - 23rd October, 2021



SPACE GENERATION
ADVISORY COUNCIL

In support of the United Nations programme on Space Applications

c/o European Space Policy Institute (ESPI)
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AUSTRIA

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About SGC

The Space Generation Congress (SGC) is SGAC's annual meeting in support of the United Nations (UN) Programme on Space Applications. Top university students and young professionals with a passion for space travelled from all around the globe to attend three days of the 19th SGC. Up to 150 delegates enjoyed an inspiring and resourceful engagement with their peers at the congress, held in Dubai, on October 21 – 23 2021, prior to the 72nd International Astronautical Congress (IAC). Delegates gained exposure to perspectives on space issues from the world's leading space organisations, including: the International Astronautical Federation (IAF), National Aeronautics and Space Administration (NASA), and the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS). In demonstrating the symbiotic relationship, leaders from these space organisations gained fresh, innovative and bold perspectives from the incoming space generation. Several sponsors along with a committee of volunteers supported the preparation of the 19th SGC. Without the support of SGAC's dedicated volunteers and the continual support of our partners and sponsors, the 19th SGC would have not been possible. In particular, two of our priorities for the 2021 Space Generation Congress were the active implementation of sustainability practices and focus on community connection. This involved Working Groups, Keynotes and Panels focusing on SDGs practices, in particular those related to using space technology to tackle climate and environmental issues, and increase of public awareness and engagement with sustainability principles and sustainable living, in addition to utilizing key technologies we've adapted to throughout the last year to maintain an online presence throughout the congress, encouraging the participation from the SGAC community worldwide.





From the Executive Office

Co-Chair's Foreword

In the last few years of the COVID-19 pandemic SGAC has faced many new challenges. But as the world has changed, SGAC has adapted with it. During this time of turbulence, SGAC members have shown that our connection is stronger than ever, that our passion still burns bright, and that our commitment to building a better future through space remains resilient.

As the world has re-opened, we have returned to in-person activities without forgetting the lessons learnt from this experience, culminating in this hybrid Space Generation Congress. The Space Generation Congress is the flagship event of SGAC that brings together space leaders of today and tomorrow for an inspiring and invigorating programme of activities. Over the course of three jam-packed days in Dubai, SGAC members reconnected in person and online, forging lasting friendships, inspiring business ideas, and launching new career opportunities.

We would like to extend our sincere thanks and congratulations to the SGC organising team, led by Kelsey and Victoria, who have worked tirelessly over the last year to put together this year's Space Generation Congress. The success of the event would not have been possible without your dedication, passion, and enthusiasm.



Harriet Brettle
SGAC Chair



Anthony Yuen
SGAC Co-chair



Executive Director's Foreword

Over the past 19 years, the Space Generation Congress (SGC) has grown into one of the key events for the next generation of outer space professionals. The event draws in delegates from around the world, heads of space agencies, and high-profile representatives from government, industry, and academia.

The annual SGC 2021 has been an excellent opportunity to share ideas and experiences, initiate collaborative projects, and network with like-minded people in the outer space sector. The discussions and recommendations over the three days at SGC will be presented at the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) sub-committee meeting.

Over the past 12 months, the SGC 2021 Organising Team has put in endless hours of volunteer time to the development and planning of SGC 2021. I would particularly like to acknowledge the SGC 2021 Manager, Deputy Manager and Organising Team for their outstanding contributions to what we believe has been an engaging SGC programme.

I would also like to acknowledge the support of all our sponsors that make it possible for SGAC to host the annual SGC, and their commitment in advancing tomorrow's space sector leaders to grow their network.



Davide Petrillo
SGAC Executive Director



From the Event Managers

The 2021 Space Generation Congress was hosted from October 21-23, 2021 in Dubai, United Arab Emirates. The event was, for the first time, held in a hybrid capacity, with 77 delegates connecting online and 77 in-person. The event was also run, for the first time, in-person in the midst of the COVID-19 pandemic. Despite the numerous challenges, the event was a great success, consisting of 6 working groups, 3 panels, 2 Sunday workshops and a running event across the October 21-24th dates.

The biggest change instituted in this SGC as opposed to past events was the incorporation of a hybrid event structure. This enabled 50% of the delegates to connect online and 50% to participate in-person. Overall, this was incredibly challenging, but very rewarding, and something I would strongly recommend the SGAC strives for in all future global events. Enabling online participation enables students and YPs a part of the SGAC that could not obtain a scholarship and do not have the necessary funds required to travel to be able to participate, and we received very positive feedback from the delegates that they were appreciative of our efforts. To facilitate this, I would recommend investment in quality equipment for online participation (such as microphones, cameras, etc.).



Kelsey Doerksen
Event Manager



Victoria Carter-Cortez
Event Deputy Manager



Programme

DAY 01 - Thursday, 21st October 2021

Time	Working Group	Theme
8:30 - 9:10	Networking	Registration and Skyrora Coffee Break 1/2
9:15 - 9:50	Intro	Intro to SGC + Expected Outcomes
9:50 - 10:00	Intro	Welcome to MBRU - Dr. Hanan Al Suwaidi
10:00 - 10:30	Keynote	Keynote: Planet, Dr. Agnieszka Lukaszczyk, Senior Director for European Affairs (In person)
10:30 - 11:00	Keynote	Keynote: International Space University, Dr. Pascale Ehrenfreund, President (In person)
11:00 - 11:30	Keynote	Keynote: NASA Exploration - Greg Chavers, Acting Deput, Associate Administrator (In person)
11:30 - 12:00		WG 1-3 Overviews
11:35 - 12:40	Lunch	WG 4-6 Lunch
12:05 - 13:00		<i>WG 1-3: Working Group Time</i>
12:45 - 13:15	Lunch	WG 4-6 Overviews
13:05 - 13:55		WG 1-3 Lunch

14:00 - 15:20		<i>WG 1-3: Working Group Time</i>
15:00 - 15:20	Networking	WG 4-6: SES Coffee Break
15:25 - 15:45	Networking	WG 1-3: SES Coffee Break
15:50 - 17:05	Panel	Climate Panel: SES, Airbus, GHGSat, NSSTC
17:05 - 17:10		SGC Day 1 Closing Remarks
17:15 - 18:45		<i>WG 1-3: Working Group Time</i>
17:15 - 18:45		<i>WG 4-6: Working Group Time</i>
18:50 - 19:20		Keynote: NASA PDCO, Lindley Johnson (online)
12:05 - 13:00	Evening Event	Space Night





Programme

DAY 02 - Friday, 22th October 2021

Time	Working Group	Theme
8:00 - 8:40		Skyrora Coffee Break 2/2
8:45 - 9:00	Intro	SGC Day 2 Welcome
9:45 - 10:15	Keynote	Keynote 5: LSA - Marc Serres, CEO (online)
10:15 - 10:45	Keynote	Keynote 4: Lockheed Martin, Mike Hawes, Vice President & Orion Program Manager, Rob Chambers
10:50 - 12:00	Panel	PPP Panel: NSSTC, Bryce
12:05 - 12:35	Lunch	WG 1-3 Lunch
12:05 - 12:35		<i>WG 4-6: Working Group Time</i>
12:35 - 13:05	Lunch	WG 4-6 Lunch
12:40 - 14:55		<i>WG 1-3: Working Group Time</i>
13:10 - 15:20	Lunch	<i>WG 4-6: Working Group Time</i>
15:00 - 15:20	Networking	WG 1-3: Bryce Coffee Break



15:25 - 15:45	Networking	WG 4-6: Bryce Coffee Break
15:50 - 16:20		Keynote: ISpace, Takeshi Hakamada, CEO (Online)
16:20 - 16:25		SGC Day 2 Closing Remarks
16:30 - 18:35		WG 1-3: Working Group Time
16:30 - 18:35		WG 4-6 Working Group Time
17:15 - 18:45		WG 1-3: Working Group Time
17:15 - 18:45		WG 4-6: Working Group Time
19:45 - 22:45	Evening Event	International Night





Programme

DAY 03 - Friday, 23rd October 2021

Time	Working Group	Theme
8:00 - 8:40	Networking	Morning Coffee Break
8:45 - 9:00		SGC Day 3 Welcome
9:00 - 9:45		Blue Origin Fireside Chat - Clay & Rich
9:45 - 10:15		Group Photos
10:20 - 11:30		<i>WG 4-6: Working Group Time</i>
10:20 - 12:15		<i>WG 1-3: Working Group Time</i>
12:05 - 12:35		<i>WG 4-6: Working Group Time</i>
11:35 - 12:15	Lunch	WG 4-6 Lunch
12:20 - 13:00	Lunch	<i>WG 1-3: Lunch</i>
12:20 - 13:00		<i>WG 4-6: Working Group Time</i>
13:53 - 14:18	Networking	ALL WG: Final Presentation Prep



14:18 - 14:23	Move	Move: ALL to Auditorium
14:23 - 15:23		WG 1-3 Presentations
15:40 - 16:40		WG 4-6 Presentations
16:40 - 17:00		SGC Day 3 Closing
19:00 - 23:00	Evening Event	SGC Closing Dinner





Programme

Sunday's Workshops

Space Medicine and Life Science half day Workshop

Time	Theme
12:30-13:00	Registration
13:00 - 13:10	Introduction to Space Medicine Workshop
13:10 - 13:20	Introduction to SGAC and SMLS
13:20 - 14:05	Keynote Speaker
14:05 - 14:15	Coffee Break
14:15 - 14:45	Student / YP Panel
14:45 - 15:15	Student / YP Panel Discussion
15:15 - 15:25	Coffee Break
15:25 - 16:00	Fireside Chat
16:00 - 16:15	Close and Awards



Programme

Sunday's Workshops

Career Development half day Workshop

Time	Theme
14:00-14:30	Registration
14:30 - 14:35	Welcoming Address
14:35 - 14:45	Workshop Intorductions
14:45 - 15:40	<i>Career Development Workshop Session 1</i>
15:40 - 15:55	Coffee Break
15:55 - 16:55	<i>Career Development Workshop Session 2</i>
16:55 - 17:00	Closing Remarks

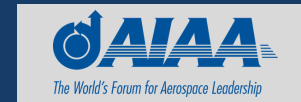




Space Night



Sponsored by



The conference evening calendar opened with Space Night, a dinner buffet and networking event to welcome members old and new to SGAC and the 19th Space Generation Congress. Hosted on the rooftop garden of the Tajj Hotel, delegates enjoyed a night view of the Burj Khalifa as they listened to a Keynote speech from AIAA Executive Director Dan Dumbacher. Dinner was followed by a game of space trivia and opportunities to meet fellow delegates.



Secret Garden, Tajj Hotel (In-person)




Side Event Activities

DAY 02 - Friday, 22th October 2021



The International Cultural Night is an annual SGC tradition where delegates take the opportunity to present their home countries and share music, food, stories, and other aspects of their culture with fellow delegates. All are welcome to wear a traditional outfit from their home place and delegates from the same country or region are encouraged to coordinate with each other to come up with ideas for the representation. The night involved dancing, singing, and appreciation of the uniqueness and diversity of the SGAC community.



 Soho Bar and Grill
(Online and In-person)



Side Event Activities

DAY 03 - Friday, 23rd October 2021

The Sahara Desert Resort provided an exciting opportunity to experience authentic Arabic culture, located in the desert in Dubai, UAE, sheltered by dunes and shared with guests from across the world space industry.

Closing Dinner



The venue comprised a traditional desert building with outdoor seating, with tables centered around a stage area to view live performances and speeches throughout the dinner.

A catered canape service was provided to delegates and guests prior to the beginning of the closing dinner, with entertainment including camel rides, Henna tattoos, falconry, and a mini Souk. Dinner was catered by a 5-star hotel, showcasing traditional arabic dishes with a starter, main course, and dessert. Dinner was accompanied by performances including an Oudh player, a Kaliji show and and Tannura and Nar show, before the conference closed with speeches from distinguished guests and SGAC members.



Al Sahara Desert
Resort (In-person)



Extra Event Activities

Sunday, 25th October 2021



SGAC Beach & Breakfast Running Challenge

Sponsored by



As an accompanying event to the Space Generation Congress and International Astronautical Congress, the SGC team hosted a “beach and breakfast” running event, hosted by our sponsor elseco. The elseco Space Team and #elseFIT coaches led delegates for a 3, 5, 7km or longer run, depending on your ability, around the track next to the ocean, followed by a complimentary breakfast on the beach.

Kite Beach (In-person)

Novotel Hotel Pool Deck (In-person)

Alumni Night/ Planet Happy Hour



The Planet Happy Hour in celebration of SGAC alumni night was a causal networking event with drinks at the Novotel Hotel Pool Deck sponsored by Planet. It was an opportunity for networking for all SGAC members in a relaxed atmosphere.

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Speakers and Experts

Working Group Speakers and Subject Matter Experts



Working Group: If Mark Watney brought back luggage: Science and discovery enabled by a Mars Sample Return



Lisa May | Chief Technologist for Commercial and Civil Space Advanced Programs at **Lockheed Martin**



Dave Murrow | Senior Manager, Strategy and Business Development, Deep Space Exploration, Lockheed Martin Space at **Lockheed Martin**



Working Group: Utilising Space Technologies for Climate Change and Sustainability



Andrew Zolli | VP Impact and Sustainability at **Planet**



Athiye Jawad | Sr. Business Development Manager at **Planet**



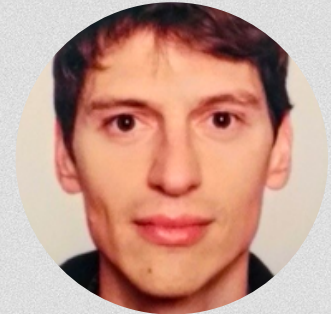
Melissa Rosa | Impact Program Manager at **Planet**



Robert Simmon | Sr.
Visualization Engineer at
Planet



Jean Marc Delvit | Head of
EO Lab at **CNES**



Santiago Pena Luque | R&D
Technical Lead on Space
Hydrology Applications at
CNES



Working Group: Space Safety and Security



Holger Krag | Head of the
Space Safety Programme
Office at **ESA**



Jan Siminski | Space Debris
Officer at **ESA**



Romane Prouteau | Clean
Space Officer at **ESA**



Gregory Pedersen | Regional Sales Director, Space at **Airbus Defence and Space**



Janice Starzyk | Vice President, Government Operations at **Virgin Orbit**



Jim Simpson | Chief Strategy Officer at **Virgin Orbit**



Working Group: Safeguarding Earth



Kelly Fast | Program Scientist at **NASA Planetary Science Division**



Lorien Wheeler | Risk Assessment Lead for the Asteroid Threat Assessment Project (ATAP) at **NASA Ames Research Center**



Brent Barbee | Flight Dynamics Engineer at **NASA Goddard Space Flight Center**



Detlef Koschny | Planetary Missions Division at **ESA**





Working Group: Artemis Site Planning and Strategic Goals for a Global Return to the Moon



Nicole Herrmann | HEDOO
Technical Integration Manager
at **NASA Marshall Space Flight Center**



Nate McIntyre | HEO
Strategy and Integration
Manager at **NASA HQ**



Erin Mahoney | Strategic
Communications Lead for
Advanced Exploration Systems
at **NASA HQ**

Event Speakers

Closing
Dinner
Speakers



Josef Aschbacher | Director
General at **ESA**



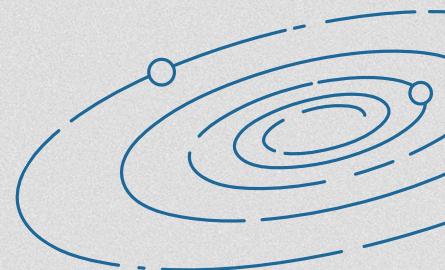
Pascale Ehrenfreund |
President at **International
Space University and
International Astronautical
Federation**



Pam Melroy | **NASA**
Deputy Administrator



Clay Mowry | VP of Global
Sales at **Blue Origin**





Space Night Speaker



Daniel L. Dumbacher | Executive Director at
AIAA

Happy Hour Speaker



Robbie Schingler | Co-founder and CSO at **Planet**

Keynote Speakers



Mike Hawes | VP, Human
Exploration and Orion Program
Manager at **Lockheed Martin**



Rob Chambers | Human Spaceflight
Strategy and Business Development
Director at **Lockheed Martin**



Maria-Gabriella Sarah |
Partnerships and Member
States Relations at **ESA**



Takeshi Hakamada | Founder
and CEO at **ispace**



Marc Serres | CEO at **Luxembourg
Space Agency**



Dr. Agnieszka Lukaszczyk
| Sr. Director for European
Affairs at **Planet**



Lindley Johnson | Planetary
Defense Officer at **NASA**
Planetary Defense and
Coordination Office



Pascale Ehrenfreund | President
at **International Space University**
and **International Astronautical**
Federation



Greg Chavers | Deputy
Associate Administrator for
Systems Engineering and
Integration at **NASA**

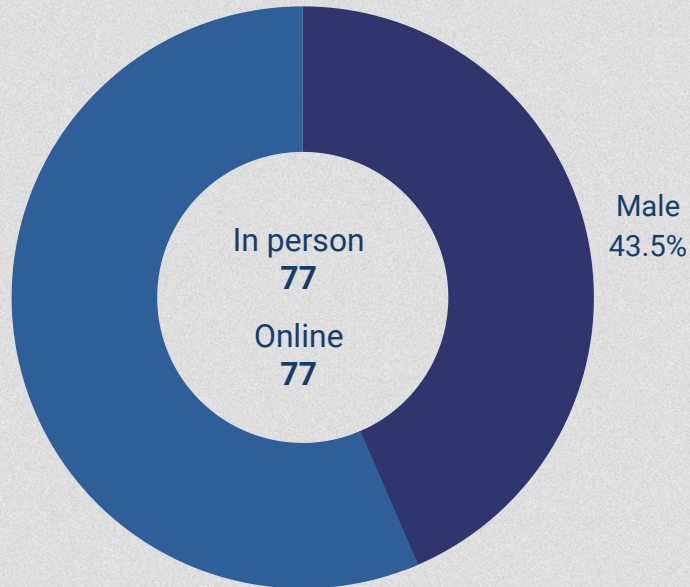




Event Statistics

Delegates
154

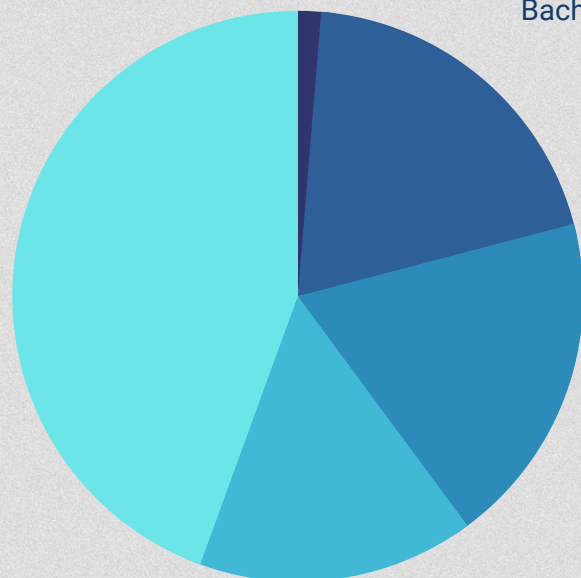
Female & Gender Minority
56.5%



High School Students
1.3%

Bachelor Students
19.6%

Young Professionals
44.4%

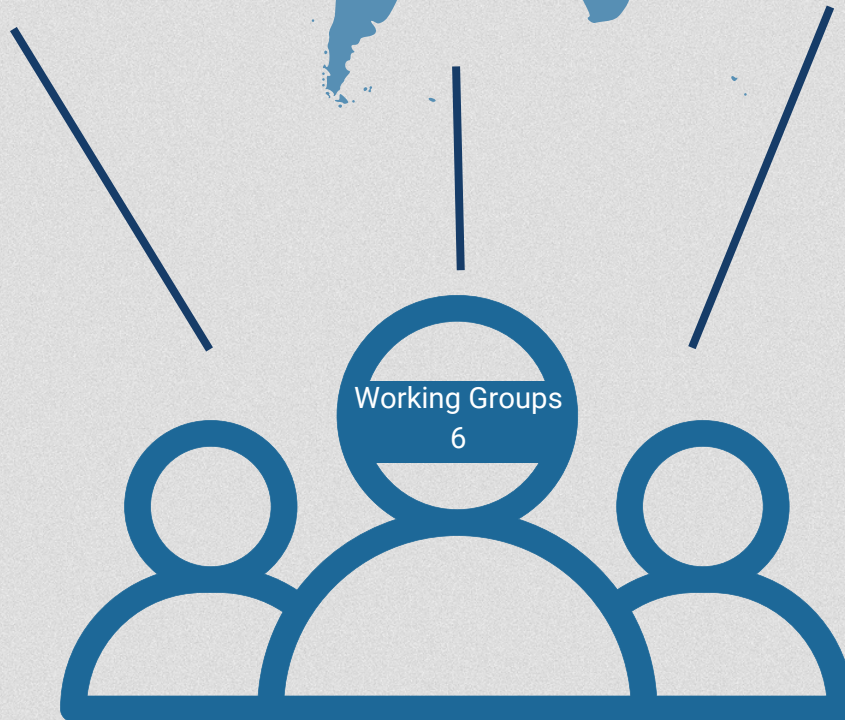


Master Students
19%

PHD Students
15.7%

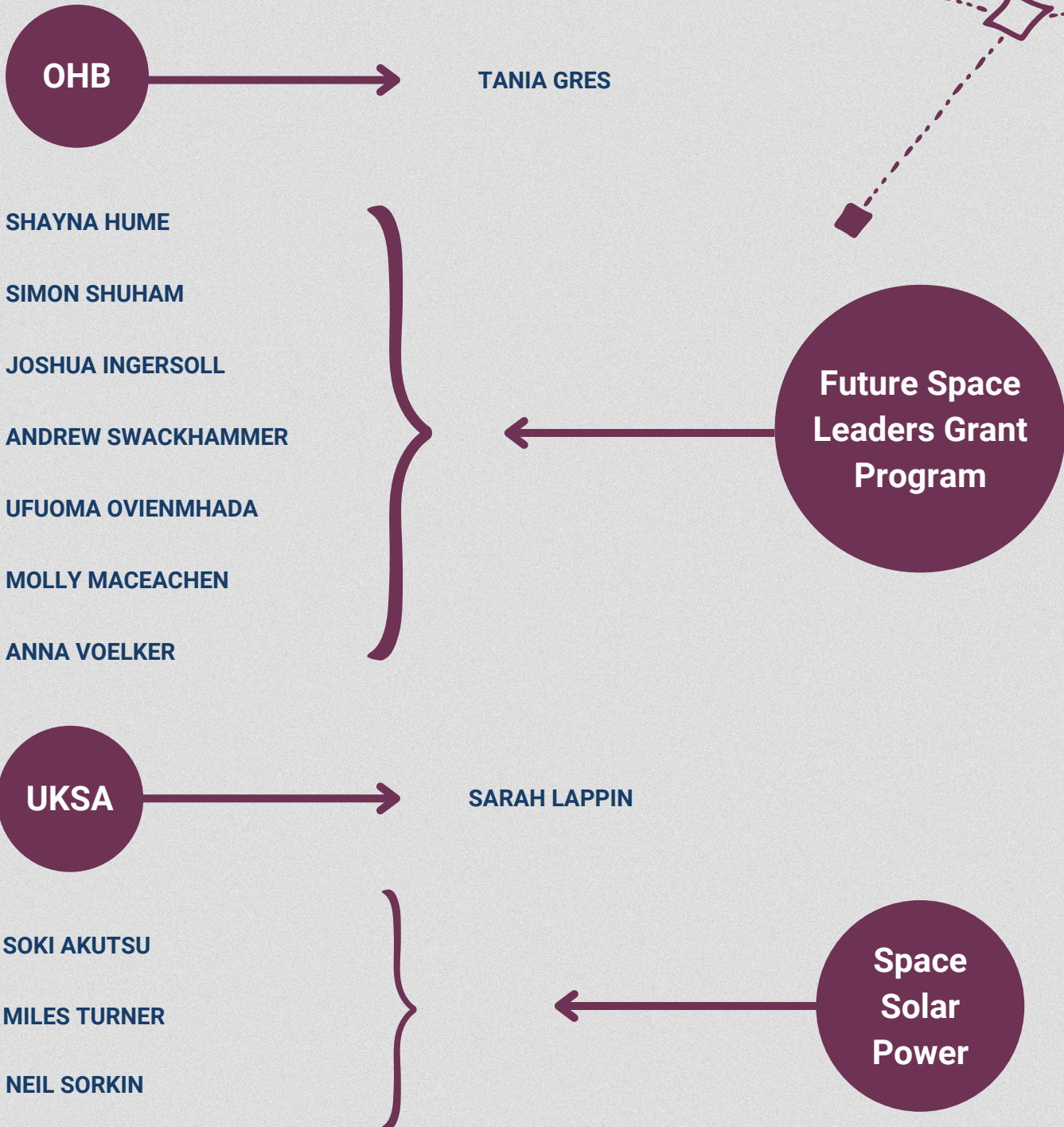
Nationalities: 58

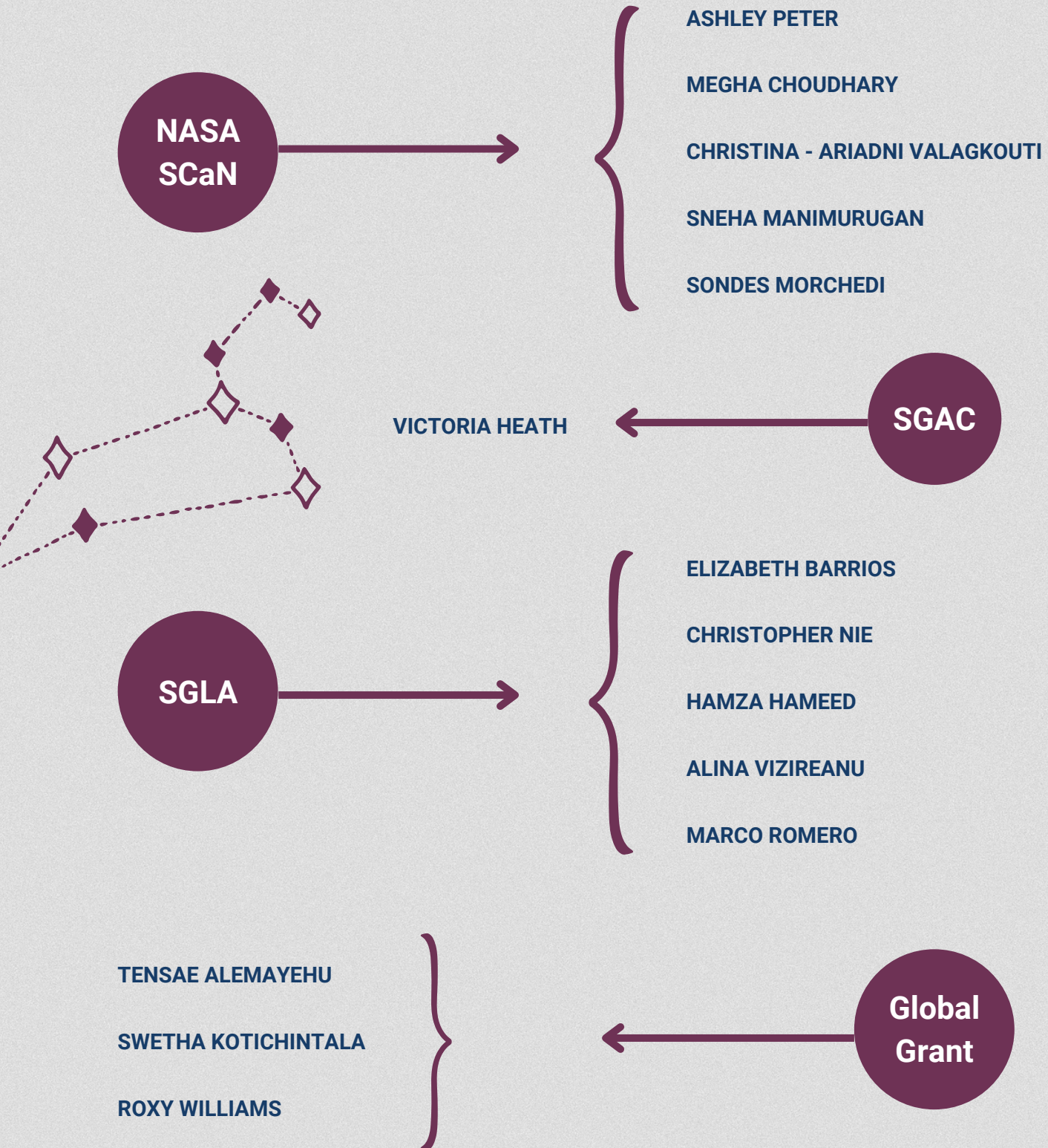
- A** Asia Pacific 20.7 %
- B** Middle East 4.5 %
- C** Europe 29.7 %
- D** Africa 13.5 %
- E** NCAC 26.5 %
- F** South America 5.4 %



Ratio of
scholarships to
delegates:
31.17%

Scholarship Sponsors and Recipients







JORDAN DIXON

MADELYN METTLER



RIC DENGEL

JUAN GARCIA BONILLA

GOURAV NAMTA

IOANA ROSCA

CALLUM WILSON

ELISE HARRINGTON



ISEB
ESA



ERIN RICHARDSON

SHAZIANA KADERALI



GIACOMO BORELLI

SOUHAIR NABIL

ANTONIA RUSSO



ASI



**Emerging
Space
Leaders**



ANGEL ARCIA

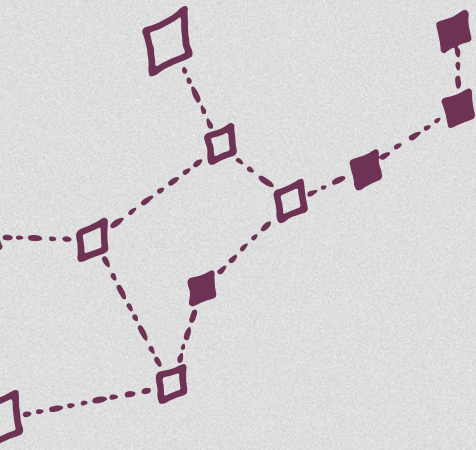
IORELLA ARIAS BONILLA

POOJA LEPCHA

MARIAM NASEEM

GIULIANA ROTOLA

RUVIMBO SAMANGA



EMILY JUDD



**NASA
Exploration**

**Chris
Boshuizen
Donation**

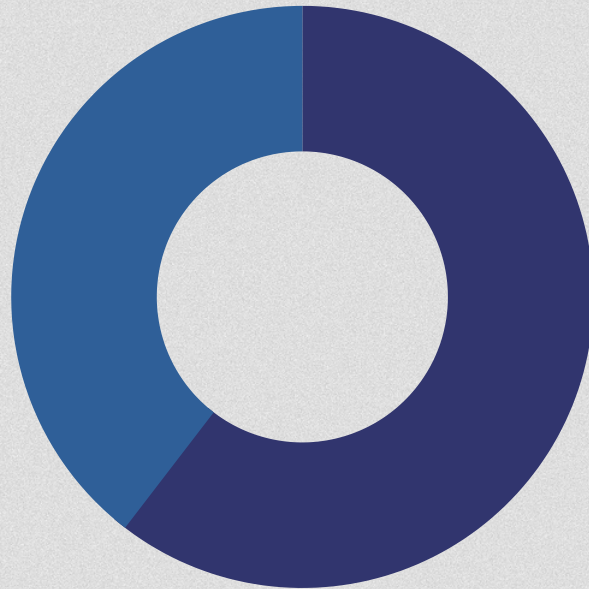


CHIMIRA ANDRES

NIKI SAJJAD

Scholarship Statistics

Female & Gender Minority
39.6%



Male
60.4%

Scholarship
Winners
48

Nationalities: 14

- A** Asia Pacific 10.4 %
- B** Middle East 4.2 %
- C** Europe 27.1 %
- D** Africa 8.3%
- E** NCAC 50.0 %
- F** South America 0 %





Working Groups



Working Group: Utilising Space Technologies for Climate Change and Sustainability

Supported by:



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On September 15, 2015 the member states of the United Nations adopted the most ambitious agenda for global change in its history, the Sustainable Development Goals, or “SDGs”. These seventeen global goals articulate nothing less than a moonshot for the simultaneous improvement of the human condition and the planet, addressing everything from poverty and hunger to clean energy and climate change. Fittingly for a moonshot, the proposed schedule to achieve these goals is fifteen years – roughly equivalent to the time between the start of the space race and the arrival of the first humans on the moon.

Earth Observation will play a critical role in fulfilling the “2030 Agenda” for Sustainable Development. Large constellations of Earth-observing satellites now produce enormous volumes of potentially actionable information about our Earth, with wide relevance to the SDGs.

Yet this trove of information is of little value if it is not synthesised into actionable insights, and then made accessible to those best positioned to take action. Routinely, elite scientific, technical and intergovernmental bodies produce indicators that never reach communities on the ground.

Delegates in this Working Group were challenged to determine what role satellite-based Earth Observation should play in addressing this “access gap”, by empowering local communities and worldwide to take informed action to tackle climate change and fulfil the SDGs. Delegates also focused on how to encourage the adoption of space-derived data by companies external to the space sector to help them understand their progress in relation to ESG guidelines.



Subject Matter Experts



Andrew Zolli | Vice President
Impact & Sustainability at
Planet



Athiye Jawad | Senior Business
Development Manager at **Planet**



Rosanne Saccone | Chief
Marketing Office at **Planet**



Melissa Ross | Impact
Program Manager at **Planet**



Aaron Smith | Product Manager,
Imagery Production at **Planet**



Jean-Marc Delvit | Head of
EO Lab at **CNES**



Santiago Peña Luque | R&D
Technical Leader on Satellite Data
Applications at **CNES**



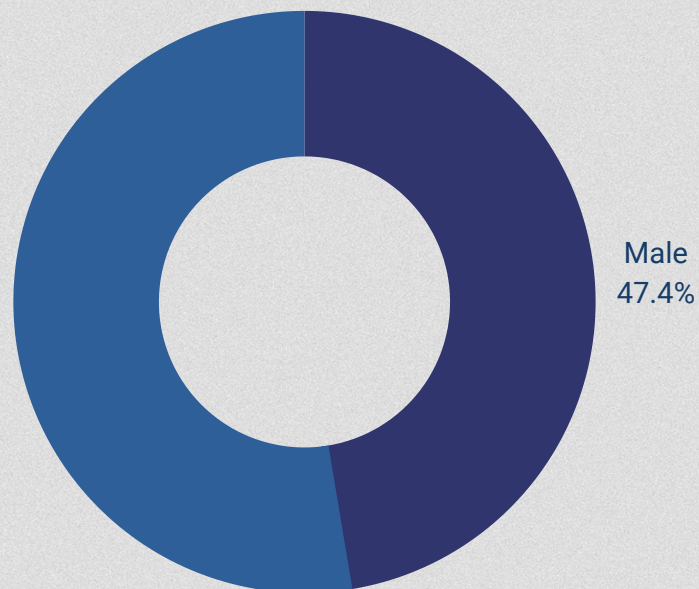
Moderator

Marco Romero | Ballistic &
Navigation Satellite Specialist
at **GGPEN**

Working Group Statistics

Delegates
19

Female & Gender Minority
52.6%



Main Objectives

- Determine what role satellite-based Earth Observation should play in addressing the access gap in EO data, by empowering local and worldwide communities to take informed action to tackle climate change and fulfil the SDGs
- Learn from industry experts about the methodology to quantify achieving the SDGs through EO data, and use this knowledge in their discussions to determine how to make this data actionable
- Understand the concept of Environmental Social Governance (ESG) and how to encourage the adoption of space-derived data by companies external to the space sector to help them understand their progress in relation to ESG guidelines



Guiding Questions

1. How do we ensure the benefits of Earth Observation data (for adaptation, mitigation, and resilience purposes) reach local communities?
2. What are visions and aspirations of the next generation on:
 - How policy can be structured to ensure ethical and democratic access to these Earth Observation tools?
 - How to use these to build new norms towards planetary stewardship?
3. Given the wide acceptance of Environmental, Social, and Governance (ESG) as a metric to evaluate companies globally, how can companies in the space sector adopt and implement these socially conscious practices?

Response to questions

1. Local communities do not have the capacity to accept Earth Observation data findings. Better tools are needed to facilitate the accessibility and interpretation of data, as well as systems to verify these tools' impact.
2. The delegates envision data platforms that are easy to interpret (with low technical barriers). They see a two-way dialogue between providers and users in these communities being key to building trust in EO data and a future where there is a global understanding of the benefits of these data.
3. The space community can create metrics and standards for ESG criteria measurements, targeted towards the space industry. This should increase awareness on ESG investing. In turn, companies should democratise their ESG responses by making their annual reports on these metrics accessible and transparent to the public.

Recommendations

Recommendations to the Space Generation Advisory Council

- SGAC should be involved in both educational capacity building and as a potential avenue for ensuring the voice of communities is represented to government bodies such as UNCOPUOS and private companies. This builds towards establishing a two-way dialogue between providers and users.



Recommendations to the United Nations Committee on the Peaceful Uses of Outer Space

- In order for the benefits of EO data to reach local communities, UNCOPUOS should work on building educational capacity for the transfer of EO knowledge to these areas
- Consider both high- and low-tech solutions; for example, in the dissemination of EO data, the UN can look to both partnerships between social media companies and the UN, but also support local practices, such as building relationships with community leaders or delivery over radio broadcasting.

Recommendations to the sponsor/partner and industry at large

- Data providers like Planet should conduct an impact assessment to identify areas where communities have poor access to their data. This should be in parallel to developing ESG standards for their companies.
- Create metrics and standards for ESG criteria measurements targeted to the space industry, and increase awareness on the usage of ESG investing. Companies should democratise their ESG response via making their information widely available.

Working Group Conclusion

Earth observation data is becoming more and more prevalent, and can offer insight in a range of fields including agriculture, public safety and health, and climate. The volume of data about our planet has the potential to help humanity reach its sustainable development goals, but the use of EO data has not been widely adopted by local communities and companies. In this working group, a team of delegates investigated the issues surrounding earth observation data as they applied to sustainability and climate change. The team's recommendations converged on developing strong communication practices: whether this be the forward communication of data or education on how to use it, reverse communication from users to organisations on their needs, or building of trust in data through strong communication.



Working Group: Space Safety and Security

Supported by:



Currently more than 27,000 pieces of orbital debris, or “space junk,” are being tracked. Much more debris exists in total, too small to be tracked, but large enough to threaten human spaceflight and robotic missions. As both the debris and spacecraft are traveling at very high speeds, an impact of even a tiny piece of orbital debris with a spacecraft could create significant problems.

The European Space Agency 2025 agenda has prioritised the expansion of Space Safety and Security related activities. This acknowledges the challenges in using space assets, with Earth’s orbit being the most important asset. The rapid increase in launch activity by both commercial and government actors threatens the safety of all space assets, and by extension, can render Earth’s orbit inaccessible.

Delegates in this working group had the opportunity to explore and identify effective ways to prevent, monitor, mitigate and remediate space debris. This is a crucial step to keep space accessible, safe and sustainable in the long term.

Working Group 1



Working Group 2





Subject Matter Experts



Holger Krag | Head of the
Space Safety Programme
Office at **ESA**



Jan Siminski | Space Debris
Officer at **ESA**



Romane Prouteau | Clean
Space Officer at **ESA**

Delegates 28

Moderator



Sara Dalledonne | Resident
Research Fellow at **the
European Space Policy
Institute (ESPI)**

Rapporteur



Andrew Swackhamer |
Research Assistant, Space and
Sustainability Initiative at **CU
Boulder**



Main Objectives

- Raise awareness amongst delegates on Space Safety and Security issues, specifically as relates to space debris.
- Explore current ideas and plans for space debris prevention, monitoring, mitigation and remediation.
- Develop potential new solutions for Space Safety and Security technology, science, and policy while exploring their opportunities and drawbacks.

Guiding Questions

1. What are the current ideas within the space debris domain and are these solutions feasible from a technical, political and economic perspective?
2. What can the space industry (public and private entities) do better to make space debris a more mainstream topic?
3. What are the resources we need (including government support and international collaboration)?
4. Can we come up with newer/different solutions for prevention, monitoring, mitigation and remediation?

Response to questions

1. Current ideas within the space debris domain include Space Safety Guidelines, Space Traffic Management and Active Debris Removal. This is not meant as an exhaustive list, merely as an example of how different solutions can run into the same obstacles. Among other, current space safety limitations comprise funding, legal uncertainty, technological limitation, and international participation.

2. On one hand, the role of the public entities is to actively engage the public about the importance of the space industry. On the other hand, the role of the private entities is to actively improve their systems to minimise space debris and to support the public entities. Three main actions can be done by public and private entities to make space debris a more mainstream topic. Improving public awareness is the first of these, and includes raising awareness at a public level and driving consumer behaviour, advocating for the importance of space, and directly informing policy makers about the issues in space safety and security. Secondly, we should actively improve space systems to minimise space debris. Finally, approaches should look to educate the next generation in these issues, through curriculum inclusion, grants and scholarships, and research initiatives at the university level.



3. The necessary resources for this include the following:

- A sustainability committee which acts as a centralised point of discussion on space safety, sustainability and security.
- A new international agreement, like the Paris Agreement, stipulating specific and top-level goals that the public and private sector can move towards. An agreement on this level would help to raise awareness and put space safety on the agenda.
- A new UN Sustainability Goal specific to the space domain. As space touches on all of the current UN Sustainability Goals, it is relevant to the agenda and also extends our sustainability goals beyond the planet.
- Further collaboration between the private and public sectors towards space safety and security. Collaboration should be encouraged between NewSpace companies, investors, venture capital firms, and incubators.

4. We propose to incentivise a de-orbiting programme for space operators, manufacturers, and suppliers. This programme would provide some kind of refund for sustainable operations. This programme should be accompanied by the implementation of a sustainability assessment, such as the Space Sustainability Rating (SSR), which evaluates the sustainability of objects launched into space. Through both of these it is important to hold launch providers accountable along the lines of the “polluter pays principle” often already seen in sustainability discussions. Monitoring data could be improved via a community approach for SSA data collection, with space-based monitoring and improvements to satellites launched with onboard GNSS and reflectors. One centralised international body should supervise these efforts, providing services such as a governing launch permit, “space police” to monitor traffic, and fostering R&D collaboration. We would hope such a body could internationally condemn the use of anti-satellite (ASAT) weapons testing in space. Initial progress should aim to “catch the biggest fish” and follow achievable targets such as removing the five most risky space objects each year, focusing on reuse/refuel/repurpose, and developing Earth-based contactless methods.

Recommendations

Recommendations to the Space Generation Advisory Council

- Support efforts to raise awareness about space security issues at the consumer and public level. SGAC could work with industrial partners to promote and raise the reputation of space safety in the industry at large, perhaps by encouraging the creation of documentaries and social media campaigns on the topic.



- Create grants and scholarships dedicated to creating awareness and finding solutions related to the space safety and sustainability problem. This would include the establishment of additional partnerships between Universities & industry/non-profit organisations in the field. The main goal is to train the next generation of space leaders to be more impactful within the industry.
- Engage with the government, space agencies and universities to promote the creation of university curriculums that are inclusive of space sustainability principles, in order for the new generations to incorporate sustainable thinking in the development of space missions. The main goal is to educate future space engineers and entrepreneurs about the effects of space debris.

Recommendations to the United Nations Committee on the Peaceful Uses of Outer Space

- Create a dedicated committee for sustainability and space debris as a centralised point for space safety and sustainability discussion.
- Develop a new multilateral agreement that stipulates specific top-level goals that the public and private sector can move towards. This agreement would ideally be similar to the Paris Agreement for wide-scale international buy-in.
- Negotiate space traffic rules, such as laws, standards, guidelines and best practices, according to the needs of each nation state.
- Add a new space-focused goal to the UN Sustainable Development Goals of the 2030 Agenda for Sustainable Development.

Recommendations to the sponsor/partner and industry at large

- Improve collaboration between the public and private sectors. Encourage NewSpace companies, investors, venture capital firms, and incubators to join the discussions with local governments.
- Create a sustainability assessment of any object that is launched to space to label satellite systems and subsystems in accordance with their level of sustainability.



Working Group Conclusion

Space Safety and Security is a sensitive subject, and crucial steps to keep space accessible, safe and sustainable in the long term are fundamental. During the activities of WG2, a team of 28 international delegates has deeply discussed the political, regulatory, economic and technological implications of the space debris issue on space applications, as well as potential solutions for the future both at the regional and international level. The result of the discussion has been summarised in several actionable recommendations.



Working Group: Artemis Site Planning and Strategic Goals for a Global Return to the Moon

Supported by:



The NASA (National Aeronautics and Space Administration) Exploration Working Group (WG), as part of the 2021 Space Generation Congress (SGC), discussed and developed recommendations on the technical, policy, legal, economic and social considerations of extending the presence of humanity to the Moon. The WG learned from NASA Subject Matter Experts (SMEs) about the Artemis program and NASA plans for sustained human exploration of the Moon. WG members were also briefed on the currently identified sites of scientific interest for Artemis, as well as the challenges and opportunities these sites hold.

Focus topics for discussion included scientific goals to be achieved on the lunar surface; ways to leverage crowdsourcing and citizen science to improve Artemis engagement and planning; opportunities for emerging space nations contribute to the Artemis missions; and analysis of how activities on the lunar surface will impact life on Earth and their relevance and importance.



Subject Matter Experts



Greg Chavers | Acting Deputy Associate Administrator for Systems Engineering and Integration for **NASA Human Spaceflight**



Erin Mahoney | Strategic Communications Lead for **Advanced Exploration Systems**



Nicole Herrman | Technical Integration, Manager for **Human Exploration, Development and Operations Office**



Holger Krag | Head of the Space Safety Programme Office at **ESA**



Merkus Geiss | Systems Engineer and Project Manager

Moderator



Sneha Manimurugan | Mechatronics Engineer



Emily Judd | Aerospace Engineer

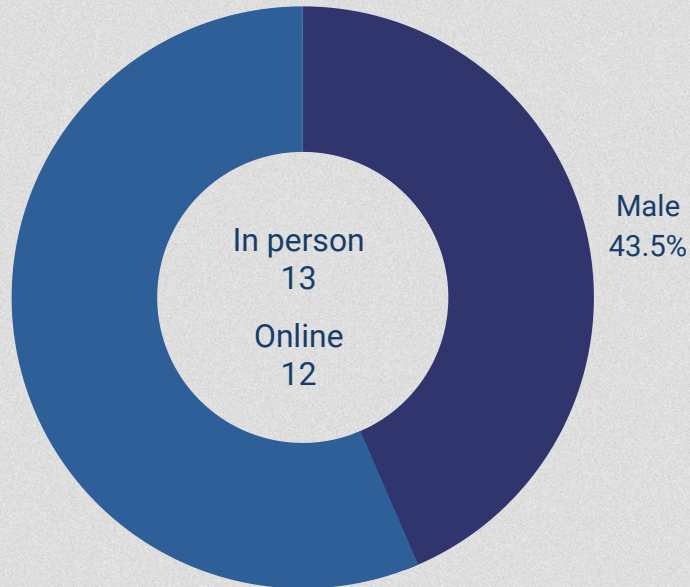
Rapporteurs



Working Group Statistics

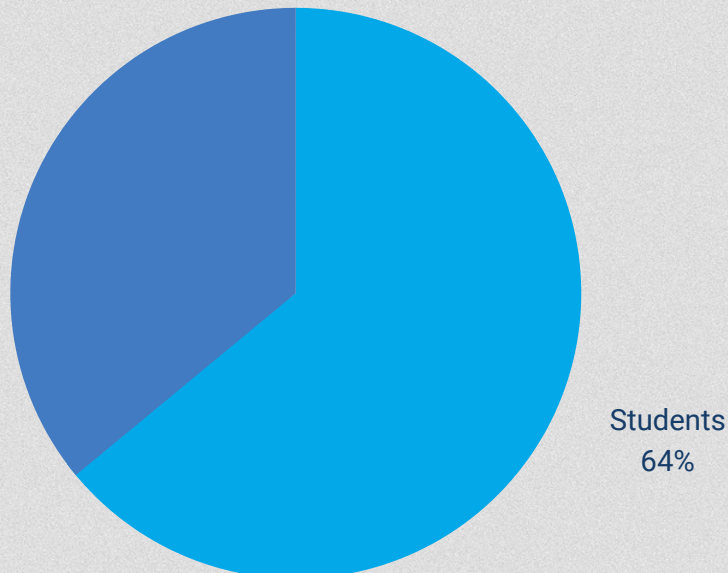
Delegates
25

Female & Gender Minority
56.5%



Nationalities
14

Young Professionals
36%





Main Objectives

- Inform the Working Group members about NASA's latest plans for Artemis and lunar exploration and development
- Inform the Working Group members about potential sites of scientific interest and the various factors that must be considered in the analysis
- Generate informed feedback from the Working Group members on the above

Guiding Questions

1. What scientific goals should Artemis crews try to achieve on the lunar surface?
2. How can NASA leverage crowdsourcing and citizen science to improve Artemis engagement and planning?
3. How can emerging space nations contribute to Artemis in meaningful ways?
4. How will activities on the lunar surface impact life on Earth and how much should this be weighed in NASA's planning?

Response to questions

1. Four themes on scientific goals were discussed: human exploration and life sciences; resource utilisation; planetary geology and lunar science; and robotics and technology demonstrations. Strategic considerations included balancing stakeholder interests, crew working hours, and scientific goals with respect to both scientific endeavours and technology demonstrations. Understanding the human body adaptation to partial and microgravity environments for longer-duration missions will prove insightful for future Mars exploration missions. Fundamental studies of the lunar surface composition and sample collection are highly prioritised by the scientific community. Technology demonstrations and the strategic use of robotics will help maximise crew productivity.

2. Artemis engagement discussions focused on prioritising open data sharing and international participation. Various types of lunar scientific data (From surface images to samples) would need to be open or assigned to participants based on expertise, emphasising opportunities for all interested parties. One specific idea was to host competitions for both the general public and technical experts, to university design competitions such as theoretical concepts or prototypes and mission hardware,



and to industry proposals on topics such as robotic experiments or lunar rover traverse plans.

3. To encourage the participation of emerging space nations in Artemis, two main areas were discussed: policy and outreach. Emerging space nations could partner with more established space nations to increase their access to space and develop and develop globally inclusive space policies. A database of space opportunities that is openly accessible could be produced, personalised to each emerging space nation, addressing both their capability strengths and challenges that could be solved with space resources.

4. The impacts of lunar exploration activities on life on Earth were broken down into three categories: human psychology, sustainability, and medical advancements. HABitat designs, accommodating size, cost and crew psychological requirements, can impact urban housing designs and land use. Crew training techniques and effects, such as the Overview Effect, can be shared with the public to potentially advocate environmentalism or reduce international conflict. ISRU and space waste management methods can be applied to tackle resource scarcity and carbon emissions. Space medicine can be applied to remote healthcare and emergency responses and to develop new technologies such as 3D printing pharmaceuticals.

Recommendations

Recommendations to the Space Generation Advisory Council

- Leverage and promote Artemis-inspired SGAC Groups to express the ideas and proposals of young professionals for science and technology research on the Moon.
- Leverage and promote Artemis opportunities for Emerging Space Nations and underrepresented groups and countries.

Recommendations to the United Nations Committee on the Peaceful Uses of Outer Space

- Promote the benefits of lunar exploration to the global community.
- Connect Emerging Space Nations with space missions that could address their national capabilities and challenges.



- Leverage and promote Artemis opportunities for Emerging Space Nations and underrepresented groups and countries.
- Refine and encourage norms of behaviour for lunar exploration protocols.

Recommendations to the sponsor/partner and industry at large

- Enable frequent communication between international stakeholders to balance differing science and research goals and values on the Moon.
- Source opinions and recommendations on Artemis research goals and priorities from the wider scientific community in a similar format to the Decadal Survey.
- Facilitate competitions open to international participation for both experts and the general public to engage with the Artemis programme.
- Ensure that there is alignment and coordination between Artemis Accords non-signatories and signatories on sustainability and interoperability.

Working Group Conclusion

Over the three days of the 2021 Space Generation Congress, the NASA Exploration Working Group produced ideas and recommendations on Artemis mission site planning and strategic goals for a global return to the Moon. The challenges around and suggestions for priorities in regard to science experiments to be performed on the lunar surface were discussed. The impacts of these science and technology demonstrations on life back on Earth were also established. The importance of involvement of the global space community at large was agreed upon, and ways to integrate international participation into the development and execution of the Artemis program were developed. Due to the multi-disciplinary skill set of the Working Group delegates, perspectives from the fields of space policy, economics, business and legal practices were also generated and examined. These deliberations enable the group to delve deeper into the nuances of interoperability among different communities and countries in order to promote a global working environment where all participants strive cooperatively towards common goals that are useful and sustainable for the future of humankind and space exploration. The main objectives of the Working Group were achieved, and recommendations for the Space Generation Advisory Council (SGAC), the United Committee on the Peaceful Uses of Outer Space (UNCOPUOS), and NASA were presented at the end of the congress.



Working Group: Safeguarding Earth

Supported by:



Planetary Defense concerns protecting Earth and dealing with the consequences of an asteroid impact. Thanks to groups such as the NASA Planetary Defense Commission Office (NASA PDCO), the risks of an asteroid impact are becoming better understood. In addition, there is increased awareness over documented Near-Earth-Objects, allowing us to improve our technical capabilities to deal with a potential asteroid impact.

The NASA PDCO collaborated with the Space Generation Advisory Council (SGAC) to sponsor a working group during the Space Generation Congress 2021 to educate students and young professionals on the main concepts of Planetary Defense. In addition, this working group went over a hypothetical impact exercise that allowed the participants to compile multiple recommendations to deal with the current technical and political issues that are yet to be solved from their point of view.

Working Group 3

Working Group 4





Subject Matter Experts



Detlef Koschney | Acting head of Planetary Defence Office at **ESA Planetary Missions Division**



Bruno Victorino Sarli | Aerospace Engineer at **HelioSpace & NASA Goddard Space Flight Centre**



Kelly Fast | Program Scientist at **NASA: Planetary Science Division**



Brent Barbee | Flight Dynamics Engineer at **NASA Goddard Space Flight Center**



Lorien Wheeler | Risk Assessment Lead for the Asteroid Threat Assessment Project (ATAP) at **NASA Ames Research Center**



Romana Kofler | Programme Officer at **UNOOSA, Committee Policy and Legal Affairs Section**



Moderator

Marcos Eduardo Rojas Ramirez | Systems Engineering Intern at the **French Space Agency (CNES)**



Rapporteur

Alina Vizireanu | Membership Manager at **SGAC**

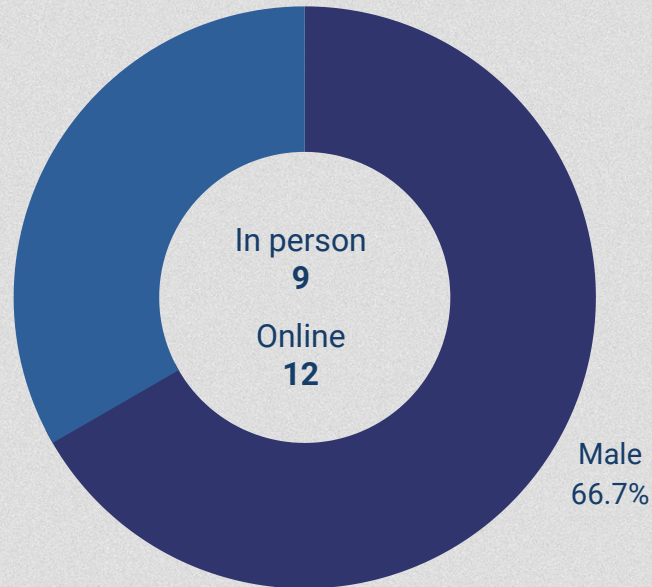


Working Group Statistics

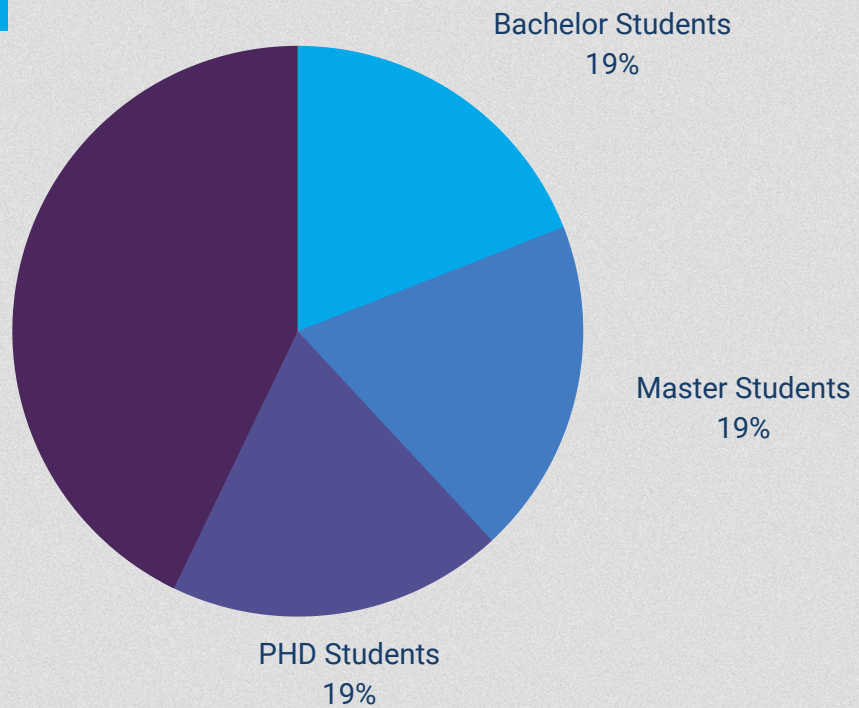
Female & Gender Minority
33.3%

Delegates
21

Nationalities
14



Young Professionals
42.9%





Main Objectives

- Educate SGC delegates on critical concepts and requirements of Planetary Defence.
- Understand and evaluate the decision-making process of SGC delegates according to their response plan during the hypothetical impact scenario.
- Enable SGC delegates to recommend and prioritise future courses of action in Planetary Defence to UNOOSA based on the outcome of their discussions and the hypothetical impact scenario.

Guiding Questions

1. What technologies, resources and regulations are available to study, understand, and possibly, prevent an impact?
2. Do we need to focus on prevention, mitigation or both (or neither)?
3. What are the main concerns of the various people affected?
4. What are the steps to take to provide accurate and timeless information to the media, public and decision-makers while maintaining the correct perception of the situation and avoiding panic and chaos?
5. Should taxpayer money be used for planetary defence if the odds of an extreme event occurring are relatively low?

Response to questions

1. Starting from the presumption that an asteroid would hit Earth within six months, and given the context of the Tunguska event that occurred on 30th June 1908, impacting over 2150 square km in central Russia, WG4 delegates assessed the active research, steady international efforts and awareness campaigns for the real threat that an incoming asteroid poses.

Aside from supercomputers and space telescopes currently used to detect asteroids, or creative industry and citizen science projects, such as Hubble Asteroid Hunter and SSERD International Asteroid Hunt, developed to increase awareness of the serious threat, in 2013, UN-COPUOS endorsed the establishment of the "Space Missions Planning Advisory Group" (SMPAG) and the International Asteroid Warning Network (IAWN) as part of Working Group on near-Earth objects (NEOs) recommendations.

We have gathered information on the current methods and their limitation. In terms of space missions, it is essential to acknowledge the development done by Hayabusa and Hayabusa 2 missions for asteroid sample return and DESTINY+ mission of JAXA planned for launch in 2024, ESA's planetary defense



mission, HERA, scheduled for launch in 2024, and NASA successfully launched mission DART, Double Asteroid Redirection Test, on 23rd November 2021.

2. According to the WHO/EHA definitions on Disaster Prevention and Mitigation management, we have concluded that our technical capabilities need improvement, specifically in addressing a framework of Prevention & Mitigation towards a sustained development of Investment <-> Action <-> Coordination <-> Policy. Therefore, the better NEO observation capabilities we have, the more likely we will detect dangerous asteroids with enough time to go for cheaper and safer prevention measures.

3. The consequences on society of an asteroid impact are very serious. We gathered information on all aspects of the society affected. Multiple concerns appeared on how this information would be communicated to the general public and their reaction to the news. In general, considering the COVID pandemic as an example, people tend to have severe reactions to such news, generating fear and panic, creating a much more complex situation. Current policies and guidelines do not consider the human factors at stake, as the psychological impact of the news to the public. To prepare better for such an event, there's a need for better-defined plans and policies that would allow us to properly manage the situation and give a sense of security to the general public.

4. Transparency coupled with effective communication where jargon and unfamiliar concepts aren't used is essential. Additionally, educational programs and informing the media first for sustained support in controlling the possible fear-mongering or release of false news outlets publications could be achieved through direct communication channels, unfiltered, from the scientists to the public.

5. As there is a relatively low impact of an asteroid on Earth, Emergency funds can be set aside in case of disaster mitigation phase, i.e. if evacuation is needed or new accommodation is sought for.

Recommendations

Recommendations to the Space Generation Advisory Council

- The working group recommends training sessions for SGAC members on colliding Near Earth Objects, and their implications for policy holders and decision makers. A program like this would require continuous effort from the Project Group, but SGC delegates would advise on aspects such as its benefits, cultural receptiveness, humanitarian aid, and technology readiness.



- The working group advises SGAC NEO-PG to foster new initiatives with the other SGAC PGs in creating awareness, collaborative projects and essay competitions about both possible and probable incoming outer space threats. These can focus on “what we could do” from a technological standpoint, as well as “what humanity would do” from a psychological side.
- Like the development of IAWN (International Asteroid Warning Network) and SMPAG (Space Mission Planning Advisory Group), SGAC delegates should actively participate in action teams, forums and workshops to address NEO threats, as well as collaborating with other institutions, universities and governments on various mitigation strategies in the event of NEO disasters.

Recommendations to the United Nations Committee on the Peaceful Uses of Outer Space

- UN-COPUOS needs to address the investment required for asteroid early detection systems. It became apparent during the NASA PDCO hypothetical exercise that the current emphasis on ‘ten years’ is long enough to address technological development, but in a highly threatening scenario in this timeline, governments measures would be challenged by social unrest.
- The implications of the COVID-19 pandemic gave rise to public skepticism in science, due to a lack of understanding of viruses and a lack of transparent scientific communication to the general public. In turn, the working group is strongly giving UN COPUOS the recommendation to pursue space education and awareness campaigns at an international level. This could be in the form of national and regional working groups which discuss, with more emphasis, the implications of imminent outer space threats and the need for continuous multinational diplomatic consultations.
- Science communication needs to be disclosed on all scientific data related to an imminent outer space threat in a timely manner, allowing the general public and scientists to study, analyse and evaluate the merit of policy decisions. Transparency in data sharing can be acquired through creating an inclusive science communication portal with real-time updates.

Recommendations to the sponsor/partner and industry at large

- Share data with multinational organisations to promote constant innovation for the industry. This should be a continuous and collaborative effort and would require support from space agencies.



- Create more hypothetical exercises, similar to this working group, related to planetary defence data/scenarios with the goal of inspiring interest in space sciences and raising awareness in planetary defence.
- Create awareness campaigns in collaboration with government authorities and space agencies with focus on individual responsibilities in the event of outer space threats. Such campaigns on plastic, air pollution, and climate change inspired the development of innovative technologies.
- Focus planetary defence considerations on presenting transparent information, decision making, and on creating dedicated governing bodies at each country level. These bodies would be responsible for fostering international collaboration and technological development across cultural, religious, and societal differences.

Working Group Conclusion

Planetary Defense is a sensitive subject that is not much discussed, despite the significant implications of dealing with such situations. However, we know in the past that it can be pretty dangerous and, while unlikely, still possible. For example, not too long ago, in Tunguska, Russia, on 30th June 1908, a meteor airburst caused a 12 megaton explosion. This explosion occurred over the populated Eastern Siberian Taiga and flattened an estimated 80 million trees over an area of 2,150 km² (830 sq mi) of the forest. We now remember this event through awareness campaigns of Asteroid impact celebrated each year on 30th June. Yet, this is not enough.

During the activities of WG4 Safeguarding Earth, a team of 21 international delegates has been part of a hypothetical exercise in understanding the implications of an Asteroid Impact. Not only have we witnessed the difficulty in grasping this news, but we have tried to go above the subjectivity of the discussions and realise the implications at the international level.

The outcome the delegates have presented is addressing the provocative legal, scientific and technological, and policy questions regarding what could and should be done in the scenarios of an asteroid being discovered on a collision course with Earth.

In unanimity, the delegates considered the exercise simulation and the 'role playing' to be fantastic. This aspect enabled everyone also to understand the position of the different stakeholders very clearly.



SGAC Special Track: International Space Development and Cooperation

Supported by:



As the modern space sector and economy globalises, and more actors – both commercial companies and countries – begin utilising outer space for various purposes and applications, the opportunities and challenges facing the international space community are growing. The diversification of the space community presents new possibilities for partnerships in Earth observation, climate and weather monitoring, disaster mitigation, and space exploration, among other activities; at the same time, it complicates the long-term coordination and sustainability of outer space activities.

Today, no one country or company can easily “go it alone” in outer space – cooperation between international space actors is becoming more important than ever to succeed in outer space, and is necessary to tackle the biggest issues of our day. This special track focused on the relationships and partnerships across the globe between commercial and civil space actors in the 21st century – identifying and addressing how they are currently working together, how they can better work together in the future, the roadblocks they face toward deeper cooperation and coordination, and the possibilities that international space cooperation can have for the future of space development.

Working Group 5

Working Group 6





Subject Matter Experts



Gregory Pedersen | Regional Sales
Director Space at **AIRBUS Defence
and Space**



Janice Starzyk | Vice
President, Government
Operations at **Virgin Orbit**



Jim Simpson | Chief
Strategy Officer at **Virgin
Orbit**



Moderator

Pauline Delande | Earth
Observation Satellite
Engineer at **CNES**



Moderator

Cody Knipfer |
Government Affairs at
Virgin Orbit



Rapporteur

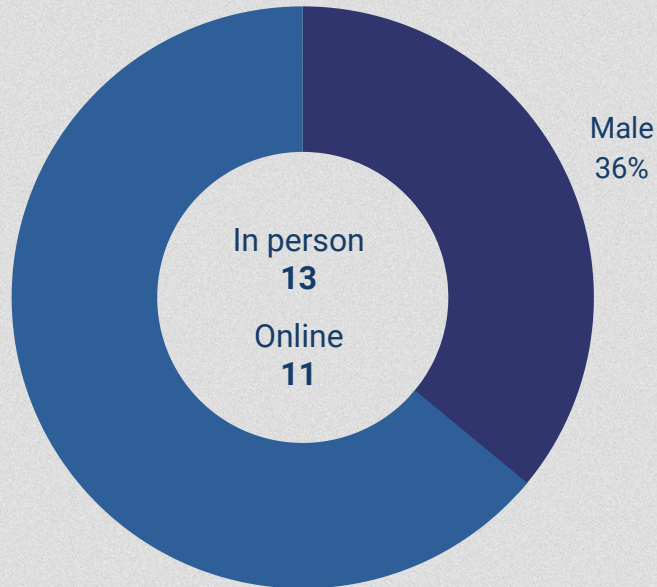
Tensae | Regional
Coordinator at **SGAC**



Working Group Statistics

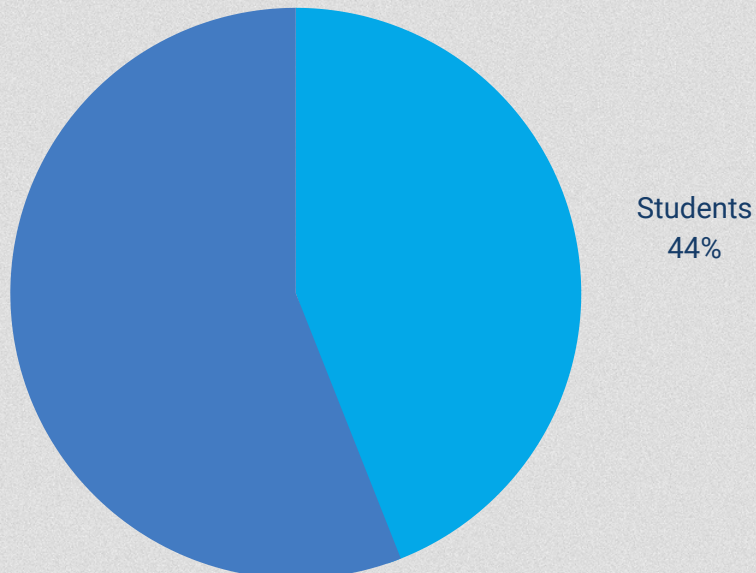
Delegates
25

Female & Gender Minority
64%



Nationalities
19

Young Professionals
56%





Main Objectives

- To discuss the current challenges for international collaboration between private and institutional organisations in the space sector
- To elaborate recommendations on how those challenges can be addressed and resolved
- To share best practices from successful collaborations to make sure that private and institutional partnerships maximise the potential benefits and are sustainable in the long-term

Guiding Questions

1. How can and should companies (such as Virgin & Airbus) work across borders and globally, with both civil and commercial partners, in the “new space” economy, addressing global problems with new technologies, new capabilities, and new approaches to space? Are there unique areas (engineering, technology, applications) that international partnerships in the “new space” arena can provide for space development, which haven’t been the case before?
2. Traditional space powers are in an ongoing process towards commercialisation of government-owned activities (launch, human spaceflight, telecommunications, Earth Observation). Emerging countries have the possibility of directly building a commercial infrastructure, skipping the first step. What are the benefits of that? For cooperation with international industry, which are the requirements for a successful long-standing partnership?
3. How can the global space sector best ensure that these different types of partnerships maximise their potential and benefit, and are sustainable for the space environment in the long-term? Are there current challenges toward deeper cooperation in private or institutional partnerships? How can these be better addressed and resolved, especially across borders? Which best practices would you put forward to make sure that private and institutional partnerships maximise the potential benefits and are sustainable in the long-term, in both legacy and emerging space powers?

Response to questions

1. From the Agency’s perspective, what is most relevant is the return on taxpayers dollars and the importance of developing a domestic labour base as well as knowledge transfer. The challenge is in adapting to where the market already is. They seem to have a dual role of both consulting and knowledge transfer. But in addition to that, it would help if agencies also focused more on making inter agency agreements. An example of this would be the NASA-LSA agreement which allows companies in either country to sell their products to the other. On the other hand, we also see conflict between agencies and governments, as for example between ESA and the EU, where both want to have the upper hand when it comes to space policy and strategy.



2. International partnerships are not bound by geography and greatly help new and emerging fields. Moon Village Association is a good example where people from different backgrounds around the globe come together to conceptualise the idea of a lunar base (Moon Village). Space resource sharing via global cooperation can benefit the various stakeholders involved. Launch capabilities and other infrastructure-heavy projects are available to these nations as needed, provided at a much lower cost by large nations or companies.

3. The key to successful, long term relationships within the global space sector is in data sharing and data compatibility. As an example, new space agencies or companies don't always know how to write proper requirements and define standards; outside partners must help them identify and define requirements and standards and amend the contract to include this piece of the process.

Recommendations

Recommendations to the Space Generation Advisory Council

- Like this working group, SGAC should continue discussion on the goals of, and barriers to, international collaboration between space and non-space players.

Recommendations to the United Nations Committee on the Peaceful Uses of Outer Space

- In order to avoid misunderstandings and take into account the different levels of knowledge in emerging space national agencies, it is recommended that UNOOSA, in cooperation with industry representatives, works towards establishing a global framework for procurement processes.
- To foster government-industry relations, we recommend UNOOSA to formally include industry representatives in the UNCOPUOS meetings. UNOOSA could act as a platform for industry and government to develop long-term partnerships.
- We recommend UNCOPUOS facilitate collaboration between foreign and local industries to develop new commercial space capabilities. They should focus on regional instead of national initiatives, ensuring some groups become truly connected to the global space economy.

Recommendations to the sponsor/partner and industry at large

- The working group recommends fostering broad engagement with emerging space companies, nations, and other players. This may, for example, take the form of associations which advocate for the inclusion of space-emerging countries, investing in their space startups, and improving education and outreach programs.
- Through partnerships with more progressed nations, development can be in new space fields like planetary defence or on-orbit servicing and assembly (OSAM) where participation would be otherwise unfeasible for emerging nations.
- To build the workforce in these areas, they recommend integrating non-space acting industries with academia to train people holistically in space and other “soft skills”.

Working Group Conclusion

This special track found that, overall, established space players play a pivotal role in developing emerging space groups - intergovernmental collaboration, education and outreach, communication and knowledge sharing, and investment into small players. While a growing community is more complex, the wealth of knowledge, if properly communicated, means that emerging players can immediately engage in areas of the space industry alongside their established peers.





If Mark Watney brought back luggage: Science and discovery enabled by a Mars Sample Return

Supported by:



This working group addressed questions revolving around the science and discovery that would be enabled by a Mars Sample Return (MSR) mission. By looking into what data we might be able to recover through MSR and how the international community could utilise this data, how this data could then be utilised to affect planetary protection and exploration policies, and how it could affect the future of human exploration of Mars and beyond, the working group developed 7 key recommendations directed to the UN, the IAF, and all interested parties.

Subject Matter Experts



Lisa May | Chief Technologist, Advanced Programs at **Lockheed Martin**



Dave Murrow | Sr. Manager, Business Development at **Lockheed Martin**



Ekaterina Seltikova | PhD Researcher at **Fluid Mechanics Laboratory of Lille**

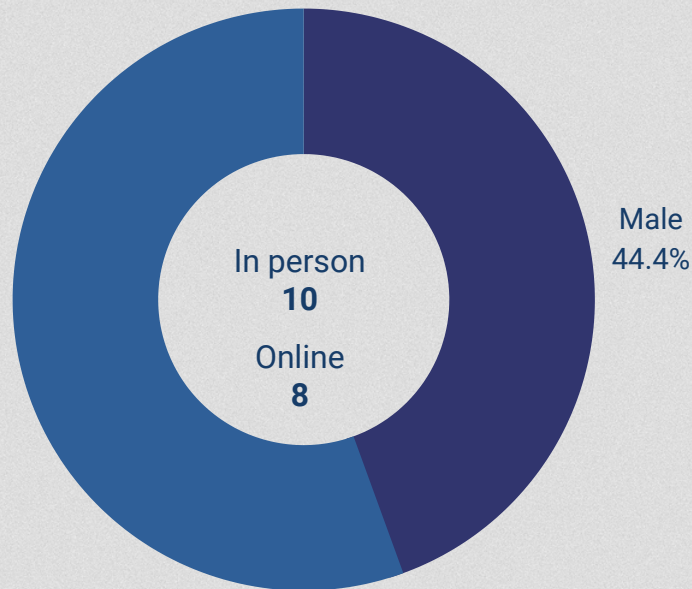


Elizabeth Barrios | Structural Materials Engineer at **NASA Marshall Space Flight Center**

Working Group Statistics

Delegates
18

Female & Gender Minority
55.6%





Main Objectives

- What high value science can be accomplished with the samples that are returned and what are ways the international science community can prioritise this science?
- How will a Mars Sample Return mission affect planetary protection and planetary exploration policies?
- What are the effects a Mars sample return mission may have on the future human exploration of our solar system?

Guiding Questions

1. How can we get the most return on investment for the very unique and rare Mars samples that will be coming back to Earth?
2. How do we develop a global agreement, and enforce it, so that we protect the red planet and Earth while still enabling groundbreaking scientific research to occur?
3. How do we prevent contamination of the Mars samples across all nations performing robotic sample return missions?
4. What additional elements of the Mars Sample Return mission should be included in order to enable and enhance the human exploration of Mars and what parties (industries, government, etc) should be involved in these discussions?

Response to questions

1. In order to get the best return on investment in the samples returned from a Mars Sample Return (MSR) mission, the samples will be divided into 3 categories (storage, mission members, open science) and be distributed based on a tiered system. Proposals will be submitted to a centralised MSR office that focuses on sample handling and will be peer reviewed based on (1) research focus area and urgency, (2) risk of damage (prioritize non-destructive initially), and (3) logistics of research (remote science, transportation, contamination control). A detailed ranking system will be developed to provide equal opportunity to all interested parties. The data discovered will be open access data.



1. In discussions, this part of Objective 2 was determined to be addressed through a combination of addressing Objective 1 (#1) and the second part of Objective 2 (#3). The two task forces that are suggested to be developed at the UN level as a result of addressing these two questions should work together intimately, which would create an environment of groundbreaking research while preserving the integrity of the Martian samples and keeping the Earth, Mars, and humans safe. Any parties that do not abide by the regulations set forth by the contamination regulatory body have the potential to be negatively ranked which would impact their access to Martian samples. Therefore, interested parties should be encouraged to work within the guidelines established so they can continue their work through MSR.

2. When considering contamination, biological contamination will be the most prevalent. Understanding the consequences of how humans interact with Mars samples and how Mars samples could affect human health are key. This includes understanding how transporting the samples across the Martian surface, returning back to Earth, and transporting across the world will impact the samples and the humans that come in contact with them. The regulatory body established in the above point should also clearly dictate what thresholds are present for different types of contamination (geographical location, type, physical environment, etc.) and detail the most common routes of contamination. These regulations should also include precisely how and when Martian samples can be transported (Earth and Mars), in addition to sustainability metric rankings in order to preserve the environment of both the Earth and Mars.

3. Basic science and development/refinement of technologies to enable human exploration of Mars is inevitable. In addition to the “expected” science, a comparison should be made to the Apollo program to understand all benefits of having a MSR before human exploration. This sort of comparison, in addition to proving the ability of a round-trip to Mars, also keeps financial parties invested in the mission and keeping the public engaged and excited. The samples retrieved should be used to develop more accurate regolith simulants to be used to support future analog missions and training simulations for Martian astronauts. A Mars Sample Return mission enables a better understanding of safety and mission design requirements in order to create an environment that promotes the success of a manned mission to Mars.



Recommendations

Recommendations to the Space Generation Advisory Council

- Focus research questions on human survivability, human safety, and sustainability in order to guide the mission development and operations for a safe launch, landing, and return of humans from Mars.
- Invest in the younger generations, in collaboration with the Partner/Industry at large, to raise awareness, create training opportunities, and create open resources related to Martian sample research and future human exploration of Mars. SGAC should provide the younger generation with the information needed to join the task forces developed by the UN and support their membership to said task forces.

Recommendations to the United Nations Committee on the Peaceful Uses of Outer Space

- Establish a task force within their sustainability groups that focuses on the handling, use, ownership, and recreation of Martian resources, including samples returned to Earth for research and the discovery of new resources on Mars from either robotic or human exploration. This task force should be inclusive of all interested parties and should have the power to enforce these policies. This task force should work directly with the industry/partners who are returning Mars samples to Earth to establish a selection matrix for research proposals and ensure open access to scientific data gained through selected research proposals.
- Establish a task force specifically dedicated towards developing contamination regulations surrounding Mars sample return. This task force should be inclusive of all interested parties to create an unbiased regulation. This task force should expand on the current entangled regulations developed by COSPAR. These new regulations should include verifiable and traceable requirements related to contamination prevention and preservation of Martian samples; define experimentally verifiable contamination thresholds; and describe methods to preserve the Earth and Mars environment. This task force should have the power to enforce these regulations by providing a sustainability metrics score to evaluate an interested party (company/industry/etc.) that could affect future MSR endeavours by that interested party (see above recommendation where this task force would feed into the scientific research).
- The above two task forces should work intimately together to establish regulations and enforce adherence to these regulations by all interested parties.



Recommendations to the sponsor/partner and industry at large

- Develop a division of samples to ensure some samples are retained for historical purposes, some are allotted specifically to main stakeholders, and some are available for open science. This division of samples should be included in the task force above related to the handling of Martian resources.
- Establish a research proposal review matrix to evaluate open science proposals to ensure research on Mars samples are both prioritized for best return on investment and is not biased towards certain parties. This matrix should also be recommended to the UN task force to be included in their regulatory documents.

Working Group Conclusion

This group dove deep into how we can promote great science from a Mars Sample Return (MSR) mission while preventing contamination and simultaneously promoting the development of advanced systems to support future human exploration of Mars. In order to create and enforce appropriate rules and regulations, and to keep the environment surrounding MSR free of bias and emotions, we suggested the creation of two task forces within the UN - one focusing on the handling, use, ownership, and recreation of Martian resources and the other focusing on contamination control. These two task forces should be inclusive of all interested parties and should work intimately together to promote the adherence to regulations set forth by both task forces. Prior to the actual collection of Martian samples, the industry at large (those collecting the samples returned from the Martian surface) should work to develop an appropriate division of samples (i.e. how many to keep for historical purposes, how many the invested parties get to keep, and how many are available for open access scientific research). This division of samples should be communicated with the UN task force on handling, use, ownership, and recreation of Martian resources. The industry at large should also invest time into creating a research proposal review matrix in order to ensure Martian samples are prioritized for the best return on investment and that selection is unbiased. This matrix should be included into the regulatory documents developed by the UN. We also recommended targeted research questions to SGAC, targeting the Space Exploration Project Group (SEPG), in order to ensure key areas of human exploration of Mars are appropriately addressed. Finally, SGAC should work with the Partner and industry at large to provide opportunities for the younger generation to be trained using advanced techniques and science developed thanks to the MSR mission. Based on these recommendations, we believe it is necessary to collect Martian samples (i.e. a round-trip Martian mission) before sending humans to explore Mars. The information gained from a MSR mission is critical to refining technologies, developing appropriate operations, and increasing understanding in order to create a safe environment for human exploration.



Report Conclusion

The Space Generation Congress (SGC) is the annual meeting of the Space Generation Advisory Council always held in conjunction with the International Astronautical Congress (IAC) at the same hosting country. The delegates are ~150 top university students and young professionals between 18-35 years old, with a passion for space. With SGC, the SGAC aims to promote the voice of the next generation of space sector leaders on the topic of international space development. Over October 21-23, 2021, the 19th annual Space Generation Congress was hosted in Dubai, United Arab Emirates, hosting 154 delegates. The event was held for the first time in a hybrid format, with 77 delegates connecting online, and 77 delegates in person. Additionally, for the first time, the SGC delegation achieved a gender representation of 56% women and gender minorities. 58 nationalities were represented encompassing the Asia-Pacific, Africa, Europe, Middle East, North and Central America, and South America regions of the world.

Summary of Working Group Findings



Working Group 1: Utilising Space Technologies for Climate Change and Sustainability, sponsored by Planet & CNES

Topic excerpt

Earth Observation will play a critical role in fulfilling the “2030 Agenda” for Sustainable Development. Delegates in this Working Group were challenged to determine what role satellite-based Earth Observation should play in addressing this “access gap”, by empowering communities local and worldwide to take informed action to tackle climate change and fulfil the SDGs.

Recommended highlights

- Find High-and Low- Tech Solutions by considering different scientific and technical abilities, and delivering the entire data spectrum, from raw to interpreted data.
- Prioritise relationships, by forming private-public partnerships to kickstart industry and taking care to be sensitive to local cultures, policies, and practices.



- Encourage strong communication and transparency by promoting the benefits of EO, building partnerships between social media companies and the UN, and curating EO benefits to local practices and technologies.

Topic excerpt



Working Group 2: Space Safety and Security, sponsored by ESA

Currently more than 27,000 pieces of orbital debris, or “space junk,” are being tracked. Much more debris exists that is too small to be tracked, but large enough to threaten human spaceflight and robotic missions. Delegates developed potential new solutions for Space Safety and Security technology, science, and policy while exploring their opportunities and drawbacks.

Recommended highlights

- Create an orbital-use fee that internalises the costs to the space environment that is caused by the addition of spacecraft via launches; these fees would be compiled and used to fund ADR missions to remove massive derelict objects such as rocket bodies or defunct payloads.



Working Group 3: Artemis Site Planning and Strategic Goals for a Global Return to the Moon, sponsored by NASA Exploration

Topic excerpt

NASA’s goal was to seek input from Working Group members to help NASA in its work, both from a technical standpoint, but also weighing the policy, legal, economic, and social considerations that go into extending humanity’s presence to the Moon.

Recommended highlights

- Leverage and promote Artemis-inspired SGAC Groups to express the ideas and proposals of young professionals for science and technology research on the Moon.
- Leverage and promote Artemis opportunities for Emerging Space Nations and underrepresented groups and countries through engagement opportunities such as design competitions, citizen science, education and resources, and a database of opportunities.



Working Group 4: Safeguarding Earth, sponsored by NASA Planetary Defense Coordination Office

Topic excerpt

NASA PDCO sought to assemble a team of delegates to educate on key concepts and requirements of Planetary Defense, and provide a podium to express their recommendations. This Working Group focused on planetary defense discussions around the hypothetical impact exercise and allowed delegates to develop policy recommendations encompassing this generation's view of the planetary defense area.

Recommended highlights

- Invest in the younger generations, in collaboration with the Partner/Industry at large, to raise awareness, create training opportunities, and create open resources related to Martian sample research and future human exploration of Mars.
- SGAC should provide the younger generation with the information needed to join the task forces developed by the UN and support their membership to said task forces.



Working Group 5: SGAC Special Track: International Space Development and Cooperation, sponsored by Airbus and Virgin Orbit

Topic excerpt

As the modern space sector and economy globalises, and more actors – both commercial companies and countries – begin utilising outer space for a variety of purposes and applications, the opportunities (and challenges) facing the international space community are growing. The focus of this working group was twofold: civil and commercial cooperation in the “new space” environment, and private vs institutional partnerships.



Recommended highlights

- Collaborate with global industries and local expertise for both space and non-space companies to solve regional problems.
- Invest and collaborate with start-ups in space-emerging countries to support development of space capabilities and to become involved in global space economy
- Develop global education and outreach programs to inspire interest and careers in space and to engage the broader public in discussions regarding space exploration, the space economy and space socialisation.



Working Group 6: If Mark Watney brought back luggage: Science and discovery enabled by a Mars Sample Return, sponsored by Lockheed Martin

Topic excerpt

Mars Sample Return is a proposed international mission to return samples from the surface of Mars to Earth for the first time. This working group challenged the delegates to analyse the needs of the program in addressing these fields.

Recommended highlights

- Focus research questions on human survivability, human safety, and sustainability in order to guide the mission development and operations for a safe launch, landing, and return of humans from Mars.
- Invest in the younger generations, in collaboration with the Partner/Industry at large, to raise awareness, create training opportunities, and create open resources related to Martian sample research and future human exploration of Mars. SGAC should provide the younger generation with the information needed to join the task forces developed by the UN and support their membership to said task forces.



Organising Team



Kelsey Doerksen - Event Manager

Kelsey Doerksen is a Space Systems Engineer and Satellite Operator at Planet, operating the world's largest Earth Observation satellite constellation. She holds a Masters degree in Electrical and Computer Engineering from the University of Western Ontario where she researched machine learning applications to space weather, in

partnership with l'Observatoire de Paris, and a Bachelor's degree in Aerospace Engineering: Space Systems Design, from Carleton University. Kelsey has previously worked at the NASA Jet Propulsion Lab in the Machine Learning and Instrument Autonomy group working on future Mars rover technology, and is an incoming DPhil student to the University of Oxford's Centre for Doctoral Training in Autonomous Intelligent Machines and Systems starting Fall 2021, where she will be developing machine learning tools to research the impacts of climate change.



Victoria Carter-Cortez - Deputy Event Manager

Victoria Carter-Cortez is an astrophysicist and aspiring space policymaker. She currently works as a consultant at PwC's Space Practice where she is actively involved in projects that support both the public and private sector in decision-making, space policy development,

and carrying out economic impact assessments. Prior to this, Victoria was working at the European Space Agency's Washington D.C. Office as part of ESA's External Relations Department. There, she analysed developments from key space actors and worked to strengthen international partnerships across the Atlantic. Victoria carried out her Master's degree at University College London where, in partnership with the Mullard Space Science Laboratory, she investigated Jupiter's X-ray auroral activity. Opening opportunities in STEM, particularly for women, is close to Victoria's heart. To this end, she has worked as an academic mentor internationally, sharing her passion for space and delivering interactive courses to engage and inspire the next generation of space scientists and engineers.



Sabrina Alam - Delegates Team

She has experience in a range of industries and took on roles within data analytics to programme management of satellites and is involved in designing STEM programmes for young people in schools in London. She is the Alumni Lead for the Space Generation Advisory Council (SGAC) and the founder and local group leader for the Luxembourg Women In Aerospace

(WIA) Group and a member of the IAF International Project/Programme Management Committee (IPMC) Sabrina is currently working at SES creating, developing and implementing the environmental, social, governance (ESG) strategy. After her bachelor's in Theoretical Physics, Sabrina decided to step foot into the 'world of space' by doing her masters at the International Space University and graduating with her master's class. During her time at ISU she went to NASA Goddard Space Flight Centre to work on an Astrophysics project and later went to ESA/EAC to work on a project relating to radiation shielding of a moon base using lunar regolith.



Alimamy Lewis Seray Conteh - Delegates Team

Alimamy Lewis Seray Conteh is a final year student pursuing a five-year Bachelor of Mechanical Engineering Degree at Fourah Bay College, University of Sierra Leone. While in university, he currently serves as the National Point of Contact for Sierra Leone at the Space Generation Advisory Council (SGAC) in support of the United Nations Program on

Space Applications, National Outreach Coordinator for Sierra Leone at the Office of Astronomy Outreach, International Astronomical Union, National Coordinator for the Moon Village Association in Sierra Leone and also the co-founder and the Executive Director of STEAD Society. Besides, he was African Union Commission Youth Scholar for the 8th The African Leadership Conference on Space Science and Technology and organising team member for the 4th Africa Space Generation Workshop in Accra, Ghana. He's also serving as delegates organising team member for the 19th Space Generation Congress which will be held in Dubai parallel to the International Astronautical Conference which is the biggest space event in the world. He has a strong conviction that we all have our part to play for the exponential development of the African continent and chooses to invest in the promotion of space issues and innovation via space technologies in Africa. He has worked extensively with STEM enthusiasts around the world to help raise the awareness in space science and astronomy in Sierra Leone and also introduce Space Science and Astronomy program in his university.



He served as event manager for the Space week activity which is actually the first-ever space activity in Sierra Leone, by coming together to interact and offer solutions on how we can collectively inspire and stimulate interest in Space Science and STEM. He also championed a space workshop with Open Cosmos UK on Space Mission Design and Analysis and he was the event manager for the 1st Space Science and Astronomy Symposium and Competition in Sierra Leone. Through this platform he's pioneering a strong group to promote and disseminate the benefits of satellite communications and technology to make Sierra Leone one of the African countries that will popularize the technology and use it in all facets of their development.





Chimira Andres - Delegates Team

Chimira is currently working at the European Space Agency (ESA) as a Young Graduate Trainee in the European Space Research and Technology Centre (ESTEC) in Noordwijk, the Netherlands, where she is also the main coordinator for ESA's Young Professionals Advisory Group (YPAG). She recently completed her MSc in Planetary Geophysics at the University of

Western Ontario, Canada. Her work focuses on (peri)glacial Arctic environments, fieldwork, satellite mission planning, Mars-icy planet analogues, and remote sensing. Chimira is part of the SG[Canada] Organizing team and is the outgoing president of the Students for the Exploration and Development of Space (SEDS-Canada). She is a strong advocate for interdisciplinary and experiential learning in STEAM (Science, Technology, Engineering, Arts, and Mathematics) as well as science communication – she aims to cultivate strong/sustainable partnerships and relationships to help bring space & resources more accessible to other students and early career professionals!



Lama Aloraiman - Delegates Team

Lama AlOraiman is a 22-years old Mechanical Engineering student at the American University of the Middle East. She is currently the Vice President of Ignition – Kuwait chapter of the Mars Society, and the National Coordinator of the World Space Week Association in Kuwait. Lama stepped into the space field in 2018 by becoming Kuwait's National Point of Contact for the Space Generation Advisory Council (SGAC). This

position opened the doors for her to be proactive within the space community by delegating in the world's biggest space conferences annually, competing in global hackathons that solve real life issues using space technology, and organizing events both locally and internationally to raise awareness on the importance of space exploration. As well as utilizing SGAC's seat at the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) to promote the voice of Kuwait's youth to the global space community. Recently, Lama was chosen by a Mentor of Space Influencers, Ksenia Synkova, to be among a dedicated focus group, and become a tutor for the first Space Influencer Mentorship Program, that has been developed on the base of her research: "Space Industry Lacks Influencers" that she presented at the International Astronautical Congress 2020.



Ayla Wolf - PR & Comms Team

Since her bachelor's degree in service management (2014), focusing on media and communication management, Ayla worked as a communicator and mediator in publishing and in the event business. She has always had a love for space, but it seemed to be something of dreams, science

fiction, or else, the realm of ("hard") science people. Having returned to university in 2015 to get first her bachelor's (2018) and then her master's degree (2020) in philosophy and cultural anthropology, she found the disciplines of Science and Technology Studies as well as Space Humanities. From then on, it was clear to her, that she would advance the research concerning space and society and bring the knowledge of it into the world – to help others on their way from seeing space as fiction to seeing it as a reality that shapes our societies.



Lisa Kucher - PR & Comms Team

After completing her Bachelor's degree in International law at the University of Strasbourg, Lisa pursued her studies at the University of Helsinki, representing the Finnish team at the European Rounds of the Manfred Lachs Space Law Moot Court Competition. In 2019 she

graduated from the International Space University's Space Studies Program, focusing on the legal aspects of advanced space propulsion systems. She also finished her Masters in Space Law and Telecommunications at the University of Paris Saclay and currently works as a legal/business analyst in a space startup.



Wijdane Benani - PR & Comms Team

Wijdane Benani is the national point of contact of Morocco for SGAC and currently studies aerospace engineering at the International University of Rabat. Apart from her field of study, she is very passionate about community service, leadership, and bringing the benefits of the space

industry and technology to humanity. From passion to action, she worked on different projects to include, inspire, and emancipate youth, promote SDGs and help to achieve them. As a well-organized, creative, and dedicated Space Camp alumni balancing between her engineering mindset and her devotion to empowering youth and impacting the society she is always excited and motivated to take initiatives and work with various teams on different projects. Wijdane enjoyed working on the organization of the SpaceGen United Congress a lot last year, and she is now very excited to be a part of the SGC 2021 Public Relations & Communications Team.



Louis-Alban De Marne - PR & Comms Team

Louis-Alban is a 24 years old French student. He is currently pursuing an advanced Masters at ISAE-SUPAERO in Space Systems Engineering. He also have a Masters degree in Aeronautical Engineering from ESTACA engineering school in France. He is a musician and played violin during 8

years when he was young. He learned communication during a one-year humanitarian mission in the Middle-East. He is passionate in everything related to astronomy since his childhood. He contributed to the organization of SpaceGen United in 2020. And more importantly, he is always happy to share his passion with others!



Oluwakorede Adejoro - Programming Team

Oluwakorede is a graduate of meteorology with experience across the logistics, banking, and automotive industries. While in the university, he was a founding member of Space club in his institution where he worked on projects including the Global Space Balloon Challenge and

volunteered at events organized by the Nigerian Space Research and Development Agency (NASRDA) and the Center for Space Research and Applications (CESRA) at the Federal University of Technology Akure (FUTA). He returned to the aerospace industry in 2020 and is currently undergoing flight operations training at Javi Aviation. He is interested in researching the usage of satellite-based augmentation system to improve air navigation safety in Africa.



Hashmita Koka - Programming Team

Hashmita is an Associate at the PwC Space Practice. She recently completed an Advanced Master's degree in Space Applications and Services at ISAE-SUPAERO and has a master's degree in Aerospace Engineering from the University of Michigan with a focus in gas

dynamics. Hashmita was the Manager for SGx 2019 and the Working Group Lead in the Programming Team for SGU 2020. She was a research assistant at the University of Michigan where she led a small satellite project and has experience in space systems engineering and project management. She has also worked for the UAE Space Agency on a digital technology project developing Virtual Reality and Artificial Intelligence experiences.



Ashley Kowalski - Programming Team

As a Project Engineer in The Aerospace Corporation Global Partnerships Department, Ashley currently works with and represents the U.S. Space Force (USSF) Space Systems Command (SSC) in developing collaboration opportunities, creating strategic alliances, deepening interoperability, and attracting new partners for current and future capabilities with

international, industry, and interagency partners to assist with and provide advice on space systems and program architecture development. Ashley's role includes recognizing partner assets that augment or fill U.S. space architecture capability gaps and recommending technical solutions. Her previous roles at The Aerospace Corporation include being an International Space Systems Analyst within the Strategic and Global Awareness Directorate and a Member of the Technical Staff within the Engineering and Technology Group, Space Architecture Department. Ashley has also lived and worked abroad through various exchange programs in Russia, Germany, and China to gain first-hand perspectives and a well-rounded understanding of the global space industry. During these various national and international assignments, she has worked on topics relating to international space systems, national security space systems, civil systems (human exploration/spaceflight & civil launch projects), space policy, satellite industry analysis, & satellite manufacturing start-ups. As one can see, molding her career into one that combines her technical background with her interest in foreign affairs & space policy is something to which she has dedicated much of her career thus far. Ashley received her B.S. and M.S. in Mechanical and Aerospace Engineering from The George Washington University in 2011 and 2012, respectively. She has previously attended Space Generation Congress 2019 and SpaceGen Summit 2020, and she is extremely excited to be part of the SGC 2021 Programming Team!



Christina-Ariadni Valagkouti - Programming Team

Christina-Ariadni is an aspiring nutrition scientist, aiming to facilitate space travel. She completed a BSc on Nutrition and Dietetics Science from Harokopio University of Athens, where she is from, and is now affiliated with Wageningen University and Research, pursuing an MSc

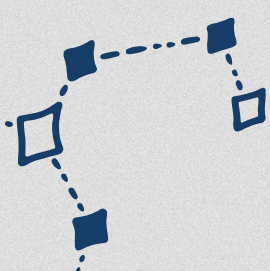
specialization on Molecular Nutrition & Toxicology. As an Education Anchor in the European Network of Dietetic Students, she has always been passionate about creating learning opportunities for everyone. Her vision of an effective space health system led her to the creation of SMLS's "Space Nutrition" sub-group, that aims to offer learning opportunities and inspiration to nutrition scientists, and to demonstrate the potential of nutrition science to mitigate common health issues of not only astronauts, but also the general population. She is excited to be in the Organising Team of Space Generation Congress 2021, as it will enable her to contribute to an event that combines constant learning and space exploration.



Cody Knipfer - Programming Team

Cody Knipfer works in the government affairs office of a commercial space company, where he is the liaison to Congress and the U.S. federal government for the organization. He graduated from McDaniel College in 2015 with a B.A. in political science, and with a M.A. in international

science and technology policy from the Space Policy Institute at the Elliott School in 2018. Prior to his current role, he held space policy positions with two aerospace-focused trade associations – the Commercial Spaceflight Federation and the Aerospace Industries Association – and spent time working in the House of Representatives handling a defense portfolio. He is a frequent volunteer for SGAC events. His most significant contribution to rocket engineering was assembling the LEGO Saturn V.





Brendan Rosseau - Logistics Team

Mr. Rosseau is a Senior Consultant with Booz Allen Hamilton in Los Angeles, where he supports space industry clients in the acquisition of space assets, business development, and business innovation. Prior experiences include space consulting in Washington D.C., crafting national space policy in Congress, aerospace startups, and astrophysical research.

Mr. Rosseau was an honors student from a top-ranked college with majors in both astronomy and economics; his academic background has emphasized independent research on the commercial space industry, including being the sole author on publications awarded at national and international levels. He is a recognized leader among the new generation of space professionals, particularly for his deep knowledge of today's space landscape, clear communication of complex ideas, formulation & execution of strategic visions, and leadership of innovative, high-performing teams.



Ani Vermeulen - Logistics Team

Ani Vermeulen has been involved with SGAC since 2017. She was a member of the SGC2018 (Bremen) and SGC2019 (Washington, D.C) organising teams, and has also served as Deputy Manager of the 2019 African Space Generation Workshop in Ethiopia. She has been honoured with the SGAC African Space Leaders Award (2018) and the SGAC Leadership Award (2019), as well as the 2017 IAF Emerging Space Leaders scholarship.

Ani holds a Master's degree in Space Studies from the University of Cape Town (UCT) SpaceLab in South Africa. Her prior education includes degrees in engineering, astrophysics and space science. In 2016 she participated in the Space Station Design Workshop (SSDW) at Stuttgart University's Institute for Space Systems (IRS) in the role of deputy project manager, specialising in cost & risk, on a project to develop a Lunar Space Station to support moon-based mining operations and conduct prototype manufacturing operations in-orbit. Ani has worked in Antarctica as a volunteer scientist/engineer for the South African National Space Agency (SANSA) on the 2014/2015 Summer Takeover, and has four years of telecommunications industry experience in business & systems analysis and process engineering. Ani's current day job is as a consulting research engineer on a variety of telecommunications and space-related projects across South Africa, but she is aiming to make an international move to work in space mission design, mission training, or mission operations, with a specific interest in crewed space habitats or planetary missions.

The coolest space thing she's ever done was remote-driving the Canadian Space Agency's Mars Rover through the Mars Yard in Montreal, from Cape Town, in a simulated 3-hour space mission. She has been obsessed with space since she was 3 years old and wishes she had discovered SGAC much earlier.



Sahith Reddy Madara - Logistics Team

Sahith is an Advanced Master's student in Aerospace Systems Engineering at the ISAE-SUPAERO (National Higher French Institute of Aeronautics and Space) in Toulouse, France. He is also doing his ITP (real-time industrial project) with Airbus Defense and Space on the topic "Optimizing the OneWeb Satellite Ground Stations Operational Availability using Model-Based Systems Engineering".

Before starting his Master's in September 2020, he worked full-time as an Aerospace Research Engineer in the Cube-Satellite Lab of the Sharjah Academy for Astronomy, Space Sciences and Technology (SAASST) – Government of Sharjah. There he was working on the development of Sharjah's 1st 3U Astronomical Cube-Satellite named Sharjah-Sat-1, for observing solar coronal holes and bright X-ray sources in our galaxy, studies conducted in collaboration with the Istanbul Technical University, Turkey. He has also contributed to the building of the second UAE Meteor Monitoring Network, UAE MMN Yahar tower, sponsored by the UAE Space Agency (UAESA), and to the Radio Astronomy group on the UAE Space Agency project, named "Detection of Jovian Radio & Solar Emission at 20.1 MHz with a Decametric Radio Telescope Array."

Notably, international speaking and achievement awards Sahith received for his work include: "24 Under 24 Leaders and Innovators in STEAM and Space Award 2020" by The Mars Generation (TMG), "Distinguished Speaker Award" from the IEEE – MBRSC Young Professionals in Space Conference 2019, Included in the "20 under 35 lists of the Space and Satellite Professionals International (SSPI) 2020 (USA)", "Research Innovation Award" from the Alleem Business Congress 2020 – Government of Sharjah, Winner of the "2019 Royal Aeronautical Society (RAeS) Young Persons' Lecture Competition (UK)", and many more.

As part of academic research, Sahith has published 32 research and review papers in various international peer-reviewed journals and presented 18 technical papers, receiving the "Best Paper and Presentation" Award for three of them. And as part of SGAC – Sahith is the UAE's National Point of Contact.

For more information please visit his personal website: <https://www.sahithreddy-aero.com/>



Curtis Monier - Logistics Team

Curtis is a young space professional originally from France and currently working in the Satellite Insurance business in Dubai, UAE. He holds a master degree in Aerospace Engineering from the EPF Engineering School in France and started his career in insurance as a Technical Analyst.

He is now a Junior Underwriter for the world single largest space insurance pool at managing general agent Elseco Ltd. After being a member of the Logistics Team for the SpaceGen United virtual event last year, Curtis is once again part of the team for this year's edition of the Space Generation Congress.





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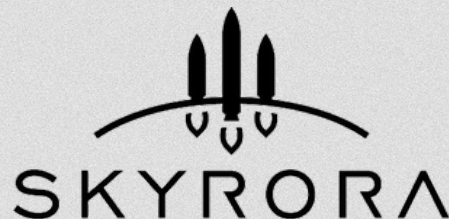
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