

**7th IAA Planetary Defense Conference – PDC 2021
26-30 April 2021, Vienna, Austria**

**IAA-PDC-21-0X-XX
ROLE OF SGAC IN PLANETARY DEFENSE OUTREACH**

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Keywords: *NEOs, Outreach, Collaboration, Planetary Defense*

ABSTRACT

The formation of the International Asteroid Warning Network (IAWN) and Space Mission Planning Advisory Group (SMPAG) was a response by the United Nations Office for Outer Space Affairs (UNOOSA) to facilitate the global planetary defense efforts and to solve the threats and challenges posed by an asteroid impact. It is recognized that an asteroid impact has wide-ranging and catastrophic consequences which would require significant resources to mitigate and/or prevent. Therefore, the participation and engagement of a global audience is critical to the success of planetary defense. Such outreach is possible through organizations like the Space Generation Advisory Council (SGAC), which has global membership, resources, a history of international collaborations and a dedicated project group that oversees and organizes activities related to planetary defense and Near Earth Objects (NEOs). The main aim of this paper is to analyse the initiatives undertaken by this project group in order to make the domain of planetary defense and NEOs reach wider masses. This paper discusses the international events, activities and projects the SGAC NEO Project Group has organized and participated in, focusing on the impacts of these programs in increasing global participation and awareness. Some of these activities include: Find an Asteroid campaign, Move an Asteroid competition, NEO Renaissance poster competition, planetary defense webinars and participation in competitions like the Mars City State Design. In the Find an Asteroid campaign, participants were from diverse backgrounds;

for some, this program was a stepping-stone for understanding what asteroids are, the threats they pose, and the importance of planetary defense, which helped increase awareness of planetary defense efforts. Similarly, the Move an Asteroid competition is a long-running initiative that has focused on some of the more technical aspects of NEOs, an important part of which is mitigation strategies for potential NEO impact threats. In order to involve less technically inclined stakeholders, NEO Renaissance poster competition was organized, attracting people with artistic talents to conceptualize NEOs in a creative manner, many of whom chose to portray defense from planetary threats. Ultimately, the findings from our activities shall be discussed in order to promote a wider outreach program that could be designed to enhance international collaborations and increased participation, while decreasing regional disparities, from all member states of the United Nations.

1. Introduction

The Space Generation Advisory Council is a global non-governmental, non-profit volunteer organisation and network which aims to represent university students and young space professionals aged 18-35 to the United Nations, space agencies, industry, and academia.



Figure 1: Space Generation Advisory Council Logo [19]

The organization itself was created at the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) in 1999 Vienna in support of the United Nations Programme on Space Application. The foundation recommendation was *“to create, within the framework of the Committee on the Peaceful Uses of Outer Space, a consultative mechanism to facilitate the continued participation of young people from all over the world, especially young people from developing countries and young women, in cooperative space-related activities”*. [18]



Figure 2: SGAC members representing the organization at United Nations [18]

SGAC has since then partnered with the United Nations Office for Outer Space Affairs (UNOOSA) [1], the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) and its subcommittees. It also has been a Permanent Observer of COPUOS, LSC and STSC since 2001 and has been a member of the United Nations Economic and Social Committee (ECOSOC) [5], since 2003.

The following paper presents an overview of SGAC's activities as a whole and also provides detailed descriptions of NEO PG's activities. Each of the individual initiatives will be discussed in detail, providing a brief yet descriptive summary of the multitude of ways in which the organization contributes to outreach focused on Planetary Defense.

1.1 SGAC Reach and Network

SGAC has been able to establish its presence in the space community through a global reach with its members coming from nearly all the nations, bringing together a diverse set of volunteers, representing 6 regions, 150 Countries and more than 15,000 members.

SGAC through its extensive network and events, has had a huge impact on the general state of space policy at every level. SGAC's network includes; Regional Chapters, Partner Organizations and Supporters and the SGAC Alumni division.

The Regional division of the SGAC network is split into;

- *Africa* - With activities spanning more than 25 African countries with over 40 National Point of Contact (NPoCs), and a focus on inviting individuals passionate about making Africa the next frontier in the global Space industry to join the team.
- *Asia-Pacific* - With activities aligned with the reservation of the talent pool for Asia-Pacific across 20 countries, dedicated to promoting and supporting young people in this region to engage in space-related activities through various outreach approaches.

- *Europe* - With a focus on developing recommendations and input concerning the future of the organization and it is interested in building a solid network within members rising their visibility at every level: in the organisation at local (across 31 countries and 50 NPoCs) and at global levels.
- *Middle East* - With 13 countries and 15 NPoCs and a focus to create and aid the rapidly expanding Space activities and opportunities in the region.
- *North and Central America* - With 11 countries and an aim to encourage participation in workshops and conferences as well as educational outreach to pass on the enthusiasm for space to even younger generations
- *South America* - With 10 countries and an aim to promote aerospace technology in the region and motivate students and young professionals to be part of the space community



6 Regions, 150 Countries, 15,000+ Members



Figure 3: SGAC Member Network[19]

1.2 Five Pillars of SGAC

SGAC focuses on enabling members to share their views and opinions on key space topics in and from the space community whilst taking part in global and local projects on vital space community-relevant topics.

One of the main focus points has been to create and provide a dynamic forum in which the youth can expand their knowledge of space issues and backgrounds while building networks and thinking creatively about the future direction of humanity's use of space.

The five pillars of SGAC are: events, project groups, professional development, scholarships, and UN-related activities.

- *Events*: Including Global, Regional, Local and Thematic recurring events
- *Scholarships*: Including awards and scholarships provided to members to attend events and to recognize achievements

- *Project Groups*: All operating throughout the year and providing diverse insights into key space topics
- *Professional Development*: Providing opportunities for personal, professional and skill-building development through volunteer opportunities within SGAC and network building
- *UN-related activities*: Engaging with the United Nations and its member states in order to work on international space issues by providing a youth perspective

1.2.1 Events

SGAC conducts various events ranging from technical webinars to workshops, networking sessions to mentoring and career events. The events and activities are conducted throughout the year.

Below is the list of activities conducted by SGAC [23]:

- *Global Events* : The Space Generation Congress (SGC) is the annual Meeting of SGAC which appoints the members from the batch of University students and young professionals sallying forth in the fields relating to the vision of SGAC. The Space Generation Fusion Forum (SGFF) takes place annually in the form of a symposium which also serves as a fast paced professional development as well as an eventual networking event. SGx at the same time as an SGAC event that focuses largely on technological aspects catering to and involving young professionals, government leaders and industry experts. [25][26]
- *Regional and local events* : Space Generation Workshop and SG [country] : SGAC motivates the passion of the young space enthusiasts catered specifically to their region as well covered in the format of workshops specific to individual sectors while the SG [country] event is dedicated in the form of conferences and scientific gatherings specific to the country.[27]
- *Project Groups activities* : Project group activities range from discussions and planning throughout the year of their activities to working on arranging separate events aligning with the objectives of each project group which ushers the involvement of a global community passionate about the same domain and on the other times the very project groups work on documenting, committing to research papers and even engaging as well as updating the global audience about recent activities and opportunities through newsletters.



Figure 4: Space Generation Congress (SGC) 2019 in Washington D.C., U.S.A [23]

1.2.2 Project Groups

Each project group in SGAC targets a specific field in the space sector. Members of each project group create discussions at the global level through writing and presenting research papers, organizing curated events to engage the community and also participating in various events, conferences and workshops. The ten project groups of SGAC include [17]:

- Commercial Space Project Group
- Near Earth Objects Project Group
- Space Exploration Project Group
- Space Law & Policy Project Group
- Space Safety and Sustainability Project Group
- Small Satellites Project Group
- Space Medicine and Life Sciences Project Group
- Space Technologies for Earth Applications Project Group
- Ethics and Human Rights Project Group
- Space and Cyber security Project Group



Figure 5: SGAC Project Groups [17]

1.2.3 Professional Development

One of SGAC's key strategic goals is to provide "opportunities for personal and professional development and skill-building through volunteer opportunities within SGAC". Through multiple events where SGAC members get to learn from experienced professionals about topics related to their career success or even with guidance on what paths to choose, SGAC as a whole offers a unique opportunity by allowing members to build a network early into their space careers. While the volunteer work itself allows members to build various hard and soft skills, SGAC also takes an active role in organizing Professional Development opportunities.

Additionally, SGAC offers a weekly Jobs Board Newsletter for its members, providing a list of vacancies in the space industry once every week and also allows recruiters to connect with SGAC's 15000 space-enthusiastic members and alumni through *Direct Connect*. Direct Connect is a Space Generation exclusive easy to use space-focused Vacancy posting service. SGAC's professional development efforts aid the industry as a whole by offering connections and allowing all parties to engage and learn alongside each other.

1.2.4 Scholarships

SGAC and its partners in collaboration host a number of diverse scholarships available to students and young professional in various domains from conferences like the Space Generation Congress (SGC), International Astronautical Congress (IAC), Space Generation Fusion Forum (SGFF), Space Symposium (SS) and other space events, workshops.

Some of the awarded scholarships are listed below [22]:

- Avascent Scholarship
- OHB Annual Scholarship
- SGAC 4STE(A)M Photographer Grant

- ILEWG Young Lunar Explorer Scholarship
- SGAC-ESA Scholarship
- SGAC-ESA Scholarship
- [IAA African Symposium on Small Satellites] SGAC – IAA Scholarship
- SGAC – Hyperion Technologies Scholarship



Figure 6: SGC 2018 Scholarship Team [22]

1.2.5 UN-related activities

The Space Generation Advisory Council, has (as previously mentioned) a history of working together with the United Nations Office for Outer Space Affairs (UN OOSA), the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) and its subcommittees, mainly the Legal Subcommittee (LSC) [3] and the Scientific and Technical Subcommittee (STSC) [4].

SGAC has and continues to be a Permanent Observer of COPUOS, LSC and STSC since 2001 and a member of the United Nations Economic and Social Committee (ECOSOC) [5] since 2003 in addition to UN for a, symposia, UNISPACE+50 (2018) and the current Space 2030, Youth 2030, Space for Women, Sustainable Development Goals (SDGs) agendas.

SGAC regularly presents reports at the UN and as a Permanent Observer at UN COPUOS[2]. SGAC members participate in STSC and LSC meetings happening annually in February, March and April preparing a Technical Presentation on SGAC's activities through the year. Additionally, the relationship that SGAC has with the UN is of a collaborative, combined capacity building nature where members are encouraged to not only participate in various UN Workshops (Regional and Global) but also constantly think about how they can contribute to the various dialogs and action items proposed during flagship events like UNISPACE+50 where SGAC organized the Space Generation Forum 2.0 (SGF 2.0); a two-day event focused on the thematic priorities and

pillars of UNISPACE+50 and resulted in a conference room paper entitled *“Recommendations from the Space Generation Forum 2.0 and the Space Generation Advisory Council in Support of UNISPACE+50”* that was disseminated at UNISPACE+50 and COPUOS in 2018.

2. Near Earth Object (NEO) Project Group

2.1 Overview

The Near Earth Object Project Group (NEO PG), is one of the main Project Groups within SGAC with a focus on Planetary defense studies and outreach. The main foundation of NEO Project Group are it's volunteers working throughout several years to achieve a common goal of raising awareness about the threats of an asteroid impact and requirements of global participation in planetary defense. The vision of this group was and remains to be focused on contributing to the worldwide planetary defense community by presenting a youth perspective and at the same time giving the youth a platform to research, learn and build a network.



Figure 7: NEO PG Logo[10]

The group itself is composed of students and young professionals who meet regularly to share information and offer multiple points of view on common issues in the space industry pertaining to Near Earth Objects and Planetary Defense. The NEO PG has a history of organizing several global competitions that serve as the group's flagship outreach events. In addition to those, the group actively participates in conferences by submitting abstracts and attending talks for research, and offers SGAC members a chance to gain experience and skills and build a network that will enable them to contribute to the Planetary Defense Community.

The group also prepares annual reports and engages in various public outreach projects whilst establishing a social media presence that provides a platform for sharing educational and informative facts about NEOs. The social media handles including the Facebook page, Twitter handle and Slack group of the Near Earth Project have been indicated in the section below, along with the outreach statistics.

2.2 Social Media Outreach

NEO PG has a strong presence on various social media platforms, and keeps its followers and the space community engaged through sharing information and organising activities. The various platforms through which NEO PG interacts are as follows.

1. *Facebook* - The NEO PG's Facebook page @sgacneo serves as the main public outreach forum with about 1,671 likes and 1,739 followers [21]
2. *Twitter* - The Twitter page @NEOProjectsSGAC acts as the focal platform to interact with competition participants and has about 472 followers [30].
3. *Slack Workspace* - The SGAC Slack Workspace is a rapidly growing platform that allows all SGAC members across different groups to connect, work together and share information. Around 2000 people are a part of the workspace and they communicate and contribute to 94 different public channels, dedicated to the different project groups, events and regions. NEO PG has an open channel here where anyone interested in Near Earth Objects and Planetary Defense can actively participate in discussions and projects.
4. *YouTube* - Space Generation Advisory Council's Youtube channel spacegeneration has 1.61K subscribers and many webinars are conducted by the various project groups and regional chapters regularly using this platform [28]. Snippets from the different conferences and workshops are also shared in addition to informative videos and documentaries. NEO PG has published a documentary related to planetary defense a few years ago on this platform. Further details about this documentary are furnished in section 9 below.
5. *LinkedIn* - SGAC has a very active LinkedIn page with nearly 19,000 followers and growing. Information related to upcoming events, projects and vacancies are shared regularly. All the activities conducted by NEO PG are publicized here. [29]

Some specific initiatives undertaken by the NEO Project Group are described in detail in the following sections of the paper. The details of the competitions listed through this paper are an overview of the goal, structure and results and do not outline the preparation phase, project management and evaluation activities the NEO PG members invest in.

2.3 Find an Asteroid Campaign

2.3.1 About the Campaign

The Find An Asteroid (FAA) campaign is an annual event organised by SGAC's NEO PG for the first time in 2021, and the International Astronomical Search Collaboration (IASC Pronounced "Isaac") [6].

IASC is a collaboration of; Hardin-Simmons University (Abilene, TX), Lawrence Hall of Science (University of California at Berkeley), Global Hands-On Universe Association (Portugal), Panoramic Survey Telescope & Rapid Response System (University of Hawaii), Tarleton State University (Stephenville, TX), The Faulkes Telescope Project (Wales), Yerkes Observatory (Williams Bay, WI), Western Kentucky University (Bowling

Green, KY), Las Cumbres Observatory (Santa Barbara, CA), G.V. Schiaparelli Astronomical Observatory (Italy), Catalina Sky Survey (University of Arizona), and Astrometrica (Austria).

Special project collaborations of IASC include China Hands-On Universe (Beijing), Astronomers Without Borders (United States), Space Generation Advisory Council (Vienna, Austria), Haus der Astronomie (Heidelberg, Germany), Target Asteroids! (University of Arizona, Tucson), NOJUM Magazine (Iran), Dark Energy Survey (University of Michigan), NUCLIO (Portugal), Asociación Larense de Astronomía (Venezuela), Clube de Astronomia Louis Cruls (Brazil), Center for Theoretical Physics (Polish Academy of Sciences), National Astronomical Observatory of Bulgaria (Rozhen), Nepal Astronomical Society (Nepal), and the Astronomical Research Institute (Sri Lanka).



Figure 8: Poster for Find an Asteroid Campaign 2020 [6]

2.3.2 Participation in 2020

Applicants from around the world were invited to participate in this 4 week event from 9th November to 4th December 2020) with special focus on teams from schools and universities. Teams were encouraged to investigate and discover asteroids using the Astrometrica software to measure the time and position of asteroids from 25 unique image sets. The campaign started on schedule receiving a total of 181 participants from teams of 3-5 members located in different countries over the globe. 50 teams were selected to participate this year from more than 15 countries.

Two participating teams made contributions to about 20 Preliminary Discoveries in total in the IASC SGAC FAA Competition in 2020, details of which are found on the IASC database.[34]

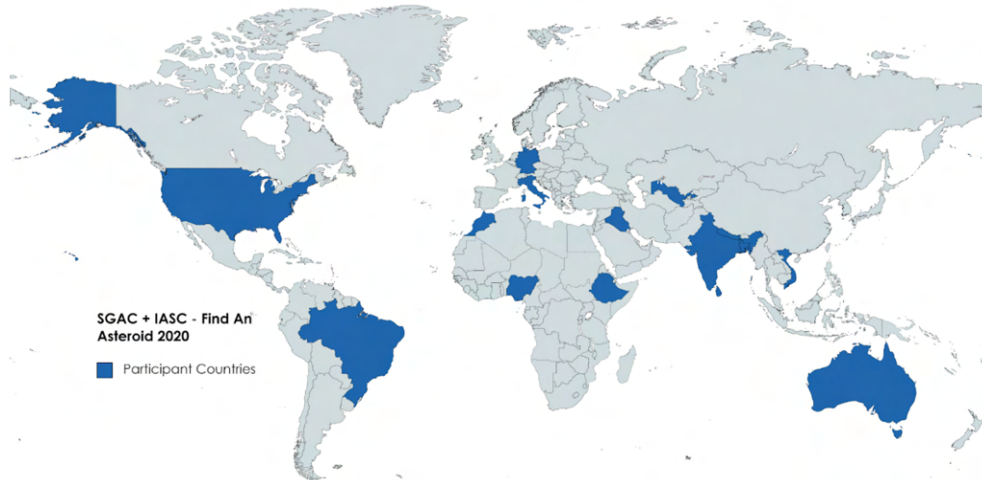


Figure 9: Participant countries in FAA 2020 [6]

2.4 Move an Asteroid Campaign

The Move an Asteroid Campaign Competition provides an opportunity to study Near-Earth Objects (NEOs) in practical detail. Astronomers worldwide are on constant lookout for undiscovered asteroids and comets and the competition allows students to experience the same discovery journey. While large-asteroid events capable of causing species extinction on Earth are few and rare and far more common objects between 10 and 100 meters large, such as those responsible for the recent Tunguska and Chelyabinsk events, can cause significant damage and loss of life, making detection and preparedness efforts all the more pressing. Experts are increasingly concerned about their likelihood from a planetary protection perspective. But to mitigate concerns, new tools have allowed the discovery of a great number of such objects in the past two decades. This competition allows people to access and utilize said tools to take part in the discovery process to learn more about asteroids and submit technical papers. It should be noted that apart from the education, detection and planetary defense aspects the competition allows for some research into general NEO mission interests like resource utilization using human and/or robotic exploration [7].

2.4.1 Submission Topics

Technical paper submissions addressing to one or more of the topics below are invited every year [7] -

1. Safe Deflection of an Earth Bound NEO.
2. NEO Study Characterization Deflection.
3. Global NEO Impact Warning System
4. NEO Resource Utilisation
5. Proposals and concepts for NEO missions Aiming at planetary defense, exploration and/or Resource Utilisation
6. NEO Impact Consequences.
7. NEO Education Programs and Strategies

8. NEO Technologies and Resources to support United Nations Sustainable Development Goals (SDGs)
9. Utilisation of NEO Technologies for Deep Space Exploration and Interplanetary Missions

2.4.2 Details of the Competition

The competition is divided into two rounds -

1. First Round - Abstract
For the first round, the participants submit an abstract within 400 words of length, that conforms to the formatting requirements of the International Astronautical Congress (IAC). The abstracts are carefully analyzed and a selected number of participants progress to round two.
2. Second Round - Paper
For the second round, the participants submit a full paper conforming to the formatting requirements for submissions to the IAC. Normally, a time period of two months is given to the selected participants to submit the final manuscript, following which the second round winner is announced.

The entrants are required to describe in technical detail an idea that could lead to an improvement or innovation in any of the above topic areas.

The main author of the winning paper receives an award to attend the following events in the month of October and give a presentation at:

- Space Generation Congress (SGC) [33]
- International Astronautical Congress (IAC) [32]

The award includes provisions for travel, accommodation and registration for SGC and IAC.

2.4.3 Overview of the Past Editions (2008-2019)

From the inception of the competition in 2008, diverse participants from around the globe have participated, and an exceptional few have received the opportunity to present their papers on a global platform. The winning papers and their authors are as listed below: [7]

- 2019: Manfred Ehresmann, *“Asteroid Control through Surface Restructuring”*
- 2018: Arunkumar Rathinam, *“Monocular Vision Based Simultaneous Localization and Mapping for Close Proximity Navigation Near an Asteroid”*
- 2017: Kristin Shahady, *“A Call for Education and Innovation in Planetary Defense”*
- 2016: Simon Molgat Laurin, *“A Gravity-Surveying Surface Lander for Near Earth Asteroids”*
- 2015: William Crowe, *“Opportunistic flyby characterisation of Earth passing asteroids”*
- 2014: Clemens Rumpf, *“Global Asteroid Risk Analysis!”*

- 2013: Massimo Vetrivano, “*Online Measurement of Very Low-Thrust Deflection Actions*”
- 2012: Sung Wook Paek, “*A Multi-Functional Paintball Cloud for Asteroid Deflection*”
- 2011: Alison Gibbings, “*A Smart Cloud Approach to Asteroid Deflection*”
- 2010: Ben Corbin, “*Implementing Advanced Technologies and Models to Reduce Uncertainty in a Global, Cost-Effective Asteroid Mitigation System*”
- 2009: Sini Merikallio, “*Moving an Asteroid with Electric Solar Wind Sail*”
- 2008: Mary D’Souza, “*A Body Solar Sail Concept for the Deflection of 99942 Apophis*”

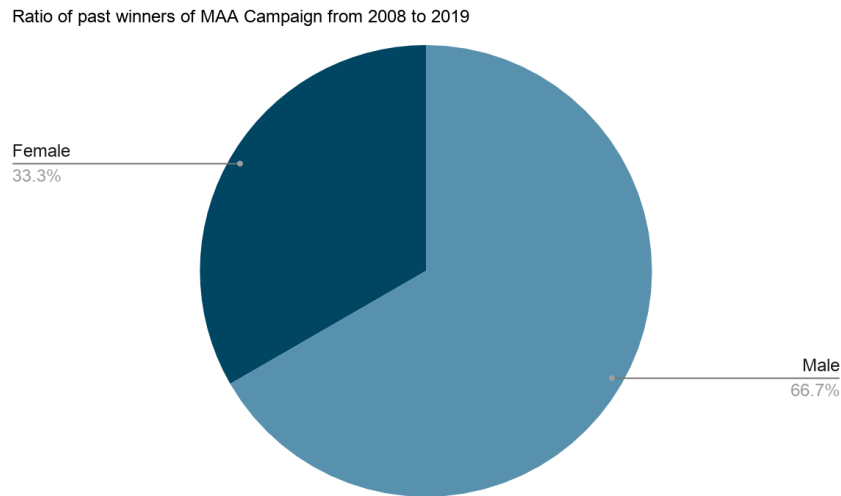


Figure 10: Ratio of Male and Female Winners from 2008 to 2019

2.5 NEO Renaissance Poster Competition

SGAC is at a unique advantage when it comes to organizing outreach events due to the audience demographic and one of the main focus points in all events has been to organize events from a STEAM i.e. Science, Technology, Engineering, Arts and Mathematics perspective allowing for non-technical expressions of scientific concepts.

2.5.1 Aim

This competition was an initiative first launched in 2020 by NEO PG members to help people by allowing them to express their creative ideas in the stressful time of COVID-19 and to keep the space community engaged.

We organised and invited applications for this NEO themed poster competition where people from space, science and artistic fields came together to submit their imaginative visual ideas as posters. This competition was launched on April 8th and the poster entries were accepted till 5th May 2020 on the SGAC NEO PG Facebook, SGAC NEO

PG Twitter. The entries were submitted on the social media handles with the tag #SGAC_NEORenaissance.

SGAC received a total of 11 posters from 10 different countries (Greece, Mexico, Angola, Nepal, United States, India, Bahrain, United Kingdom & Austria). [8]

2.5.2 Submission Topics

- Planetary Defense Heroes : How would you defend our planet from an asteroid impact? Show and tell us how you would save lives on our planet from an asteroid impact.
- New Near-Earth Alternative Destinations: What does your second home on a Near-Earth planet or an asteroid or a moon look like? If humans had to leave the earth in an emergency, for what destination in outer space would you take us and how would you make it all possible until we are safe in our second home.
- How asteroid impacts led to the extinction of the Age of Dinosaurs? Share with us how 65 million years ago a massive asteroid impact could have contributed to the extinction of the dinosaurs and 75% of life on Earth [8].

2.5.3 Results of the competition

The SGAC announced the winners of this competition in three different categories:

1. The Most Scientific
2. The Most Creative
3. People's Choice

The participants and the winners of the competition represented a diverse set of nationalities, age groups and gender.

2.5.3.1 Winners for Most Scientific Award Category

1. Participants: Christina Bornberg (Austria) & James McKeivitt (United Kingdom)

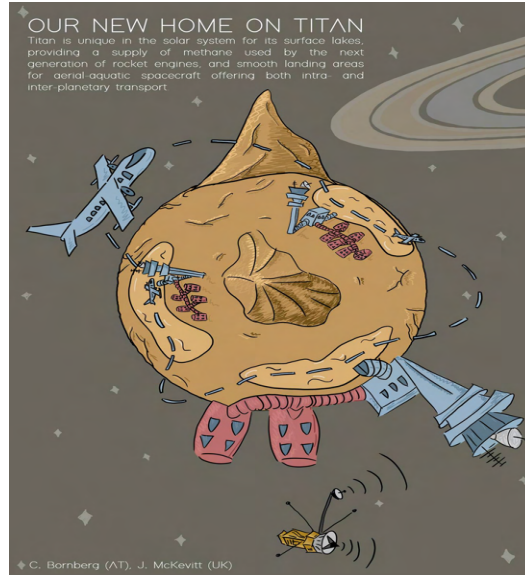


Figure 11: Winning Poster for Most Scientific Award Category; Credits: Christina Bornberg, James McKeivitt [8]

Submitted Description: *“Our new home on Titan! Titan is unique in the solar system for its surface lakes, providing a supply of methane used by the next generation of rocket engines, and smooth landing areas for aerial-aquatic spacecraft offering both intra- and inter-planetary transport”* [8]

2. Participants: Elias Sanjelembe (Angola)



Figure 12: Winning Poster for Most Scientific Award Category; Credits: Elias Sanjelembe[8]

Submitted Description: *“The last Angolan Dinosaurs were unable to calculate the trajectory that would extinguish them but we can. Here is a poster in the form of an*

inheritance from the Ancestral traditions of Angola that proves the existence and the extinction of the Dinosaurs when a rain of meteorites fell on the Bengo Province in Angola.” [8]

2.5.3.2 Winners for Most Creative Award Category

1. Participants: Emilie Estrada (Mexico)

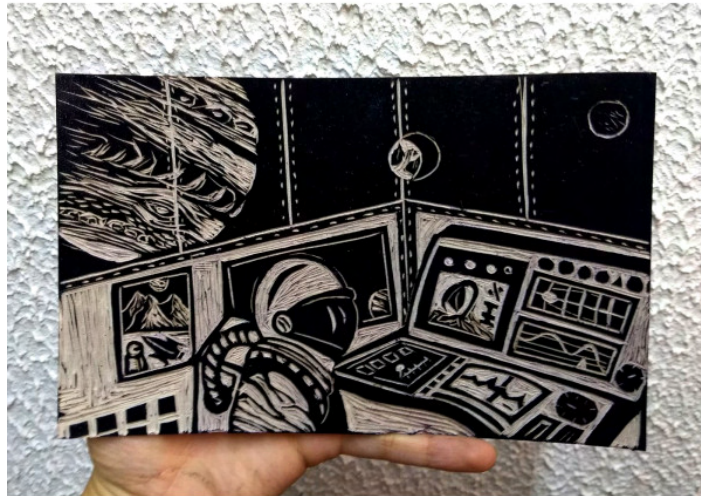


Figure 13: Winning Poster for Most Creative Award Category; Credits: Emilie Estrada[8]

Submitted Description: *“Our place, Europa. Pioneer, Voyager, Galileo and New Horizons all watched our new home.” [8]*

2.5.3.3 Winners for People’s Choice Award

Winning Team: Robot Birds Team (Athens, Greece)



Figure 14: Winning Poster for People’s Choice Award Category; Credits: Robot Birds Team[8]

2.6 Mars City State Design

2.6.1 Purpose

SGAC took part in the Mars Society’s Mars City State Design Competition 2021 for the first time and it was a flagship cross-collaboration between teams from 6 different SGAC Project Groups (PGs). The PG co-leads and 27 selected team members – some even new SGAC members - all worked closely after going through a brief recruitment in May 2020 (out of over a 100) [31].

2.6.2 Role of NEO PG

The NEO PGs position was a unique insight in the overall design proposal, and while individual members were able to offer expertise in different technical, socio-economic and political fields to design and justify the model of the Mars City State, NEO PG had started looking into adding fairly detailed research on Mining Technologies on the ground and from the asteroid belt. NEO PG was able to provide insight into planetary defense technologies and needs that would feed into various aspects of the Mars City State design itself.

2.6.3 Results

The SGAC team was selected to present their model at the finals as a Top 10 candidate[15]. While the design did not make it to the Top 5 prizes, the SGAC team were able to set a precedent for how future PGs could collaborate specifically for large design projects that need varied inputs. As a result of the competition, the SGAC report will be published in the Mars Society’s design book titled “*Mars City States: New Societies for a New World*”.



Figure 15: Mars City Design Team [15]

3. NEO Technical Committee Collaboration with IAF

3.1 International Asteroid Day 2020

In collaboration with IAF NEO Technical Committee, NEO PG released its First Newsletter on 30th June 2020. This was the First Newsletter issued by NEO PG and was also the First Special Edition which featured an interview with the SGAC NEO PG founder : Alex Karl, Chair of IAF NEO Technical Committee. NEO PG Collaborated with Alex for this interview to celebrate the International Asteroid Day. In terms of this collaboration with IAF NEO Technical Committee, NEO PG is supporting the Planetary Defense Conference 2021 organised by UNOOSA through sharing participation calls on the NEO PG monthly newsletters. NEO PG also collaborated with SGAC Social Media Team to organise a social media campaign on all SGAC Social Media Pages and NEO PG Facebook, Twitter Pages. All PG members shared NEO Facts as a 5 days countdown to International Asteroid Day 2020 [11].



Figure 16: Poster of the first newsletter of NEO PG [11]

3.2 AIAA - LA Planetary Defense Virtual Panel

NEO PG has also collaborated with Nancy C. Wolfson, the Vice-Chair of IAF NEO Technical Committee. The Vice-Chair invited Smiriti Srivastava, the NEO PG Co-Lead for a virtual presentation on the topic "*Planetary Defense from Near Earth Objects (NEO's)*" at AIAA - LA Planetary Defense Virtual Panel in Dec, 2020 together with Mariella Graziano, an IAF NEO Technical Committee member[9].



Figure 17: IAF NEO Technical Committee: AIAA - LA Planetary Defense Virtual Panel [20]

4. Near Earth Objects and Planetary Defence Documentary

SGAC's Near-Earth Objects and Planetary Defense is a NEO PG documentary, "*A Film About Defending The Earth*", which talks about the concerns of NEO impacts and the threats they pose to life on Earth. The whole documentary, posted in 2011, has more than 50,000 views on YouTube.

The documentary includes insights from international experts, researchers and scientists, who came together and offered their views and ideas on arranging, funding for, building, and securely executing a mission to stop a NEO impact.

The documentary starts with the narrator, Ryan Anderson, explaining what NEO's are and why they are important. The video then pans to interviews of the people who attended the 2009 IAA Planetary Defense Conference in Grenada, Spain, who explain their thoughts about NEO impacts and the different ways they could stop a NEO collision.

The interviewees included, Alan Harris from Space Science Institute, Ben Rozitis from The Open University, Prof. Zeljko Ivezić from LSST/University of Washington, Nick Bailey from University of Southampton, Dr. William Ailor from The Aerospace Corporation, Dr David Morrison from NASA Ames Research Center, Christie Maddock from University of Glasgow, Rusty Schweickart from B612 Foundation/Association of Space Explorers, Tejal Thakore from SGAC, Aline Zimmer from Institute of Space Systems, University of Stuttgart, Soughata Pahari from Politecnico di Milano and Tomohiro Yamaguchi.

Planetary defense is a very important topic that must be at the forefront of discussions about the space sector, as it has wide-ranging impacts on life, economy and health. Thus, this documentary by the NEO PG, filmed in 2009, is essential in creating a basic awareness among people [24].



Figure 18: YouTube SGAC Channel-Documentary on Near Earth Objects and Planetary Defense [24]

5. UN COPUOS Scientific and Technical Subcommittee (STSC) Meetings

Since SGAC is a Permanent Observer at UN COPUOS, it presents the outcomes of all its conferences and projects annually at:

- Scientific and Technical Subcommittee Meeting (held in February)
- Legal Subcommittee Meeting (held in March)
- General Assembly Meeting (held in June)

The co-leads of each project group of SGAC are invited to present their activities at these meetings.

The NEO Project Group of SGAC annually submits and presents the following results at the annual session of the UN COPUOS General Assembly subcommittees; the Scientific & Technical Subcommittee and the Legal Subcommittee:

- FAA Campaign
- MAA Competition
- NEO Renaissance Competition
- Published papers at IAC, PDC and GLEX
- NEO Projects that raise awareness about Planetary Defense
- NEO Projects that support UN Sustainable development goals

The Near-Earth Project Group (NEO PG) has been actively participating in the United Nations General Assembly. Several important decisions and policies have been brought to action in these meetings. The subcommittee has heard various reports on the NEO PG activities and a brief overview and conclusions of the meetings are as given below.

Sub-sections 5.1 to 5.4 highlight the several important panel discussions that took place in the United Nations General Assembly and these annual reports are distributed and discussed with the NEO PG members to engage critical thinking skills whilst deepening the group's knowledge base;

5.1 UN General Assembly 2015

In the United Nations General Assembly of 2015, under item 11 (Near Earth Objects), various statements relating to Near Earth Objects were made by the representatives of other member states and by the observers for ESA, SGAC and SWF. Various Scientific and Technical presentations were heard by the Technical Committee. The subcommittee noted that effective responses for the mitigation of hazard threats of Near Earth Objects (NEO's) were best addressed through international cooperation and coordination of related research and knowledge of best practices. The subcommittee recalled its earlier agreement that the work of the International Asteroid Warning Network (IAWN) and of the Space Mission Planning Advisory Group (SMPAG) should be facilitated by the United Nations. [12]

5.2 UN General Assembly 2016

In the United Nations General Assembly of 2016, in accordance with the General Assembly resolution 70.82, the scientific and technical subcommittee considered agenda item 12, Near-Earth Objects. Under this agenda, various statements were made by the observers for ASE, IAWN and SMPAG. The subcommittee heard 'SMPAG report to the scientific and technical subcommittee, 2016 by the observer for SMPAG'. The subcommittee heard the report by the chairs of IAWN and SMPAG on their activities and welcomed with appreciation the progress made by those two groups in the area of strengthening international cooperation in mitigating a potential NEO threat. [13]

5.3 UN General Assembly 2017

In the United Nations General Assembly of 2017, in accordance with the General Assembly resolution 71/90, the scientific and technical subcommittee considered agenda item 11 'Near-Earth Objects. Under this agenda, various statements were made by the observers for ASE, IAU, IAWN and SMPAG. The subcommittee heard status reports by SMPAG and noted with appreciation the efforts made by SMPAG to share information with regard to discovering, monitoring and physically characterizing potentially hazardous near-earth objects in order to ensure that all nations, in particular, the developing countries with limited capacity to predict and mitigate an impact of a near-earth object were aware of potential threats. [14]

5.4 UN General Assembly 2018

In the United Nations General Assembly of 2018, in accordance with the General Assembly resolution 72/77, the scientific and technical committee considered agenda item 12, 'Near-Earth Objects'. Under this agenda, various statements were made by the

observers of IAWN and SMPAG. The subcommittee noted that SMPAG was continuing to work with the Office for Outer Space Affairs on issues related to general communication on near-earth objects by public communication with member states in the event of an impact warning. The subcommittee also noted that a brochure on near-earth objects and planetary defense was being prepared by IAWN, SMPAG and the Office for outer space affairs. [16]

6. Conclusion: Future Scope

An organisation like SGAC is a critical need at this stage of the dynamic space revolution environment. The intent behind SGAC's creation in the first place, is to provide a platform for students, young professionals to voice out their opinions and be a part of the largest network of students, young professionals and alumni in the space industry. SGAC has created a dynamic path, and invites more organisations to engage to fulfill the mission to nurture the next generation of space leaders and create an impact together.

NEO PG intends to continue and follow its motto by aiming to engage a larger audience and increase global participation in the various events like; Find An Asteroid, Move An Asteroid and the NEO Renaissance competitions and possibly more. There will also be a focus on creating and participating in more campaigns and encouraging members to actively participate in the UN activities and meetings whilst also increasing the involvement with international space committees like IAF via events and conference publications.

There will also be a focus on organising more webinars and talks focusing on NEOs and the threat the near-earth objects possess to our humankind to focus on public outreach and educate a larger audience by making knowledge available and accessible.

One of our primary goals is to reach out to as many space enthusiasts as possible, and the plan is to do so via digital platforms. NEO PG strives to create more awareness about the NEO's through not only social media activities but also by allowing its members to interact with the community to build their skills and provide them with a platform to express their ideas.

NEO PG has and continues to be the bridge between the Planetary Defense Community and aspiring youth wanting to learn and contribute to the cause, in addition to also providing a looking glass platform to the general public to showcase the industry and community's progress. What has been presented is a brief summary of all the major events and activities NEO PG and SGAC's network, focus on contributing to the space community and showcase just the tip of the iceberg of effort being poured in. With the goal to improve communication and encourage the exchange of ideas and knowledge, SGAC as a whole plays an important role in building space capabilities by molding skills and gaining public support and will continue to do in the future.

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