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12TH ANNUAL SPACE GENERATION CONGRESS: AGENCY SESSION REPORT ON SPACE
COMMUNICATIONS IN OUR DAILY LIVES

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Space applications, particularly those related to space communications, play a significant role in society and in our technologized world. Communications satellites are vital in supporting our global information infrastructure and a multitude of critical activities on a daily basis. From navigation, to weather forecasting, disaster response, and search and rescue efforts, economic and national security is becoming increasingly tied to space communication assets. As such assets become an increasingly necessary part of daily life, expanding global awareness and imparting the benefits of space communications to the general public is essential. This paper focuses on identifying the benefits of space communications in daily life and outlines strategies for conducting public and stakeholder outreach. This study sought to define the content to be communicated, and established an educational and dynamically integrated video, image, and game application campaign as the most effective means of targeting and engaging stakeholders. In order to successfully integrate a global campaign, coordination with a neutral organization comprised of active students and young professionals, such as the Space Generation Advisory Council (SGAC), was recommended. Collaboration with existing outreach campaigns, such as NASA's International Space Apps Challenge and U.K. Catapult "Future Cities" were evaluated as strategies for funding. This study recommended that the outreach strategy be divided into several short, medium, and long term efforts in order to provide an interesting chance of return on investment if stakeholders, such as satellite communications providers, were to consider participating in the short term efforts discussed in the working group, thus establishing a basis for medium and long term outreach phases. This study was conducted in support of NASA's Space Communications and Navigation (SCaN) Program and undertaken during the Space Generation Congress of the Space Generation Advisory Council in September 2013. This final paper outlines the strategies and recommendations of representatives of the young generation from 14 countries.

I. INTRODUCTION

Space applications, particularly those related to communications, have become a significant part of humanity and an integral part of daily life, although the general public may not realise it. There are often stories about a communications satellite that has been

partially or completely disabled as a result of a solar flare or a collision with another satellite, and yet only a small group in the world understands the repercussions of these events.

As economic and national security are increasingly tied to space-based assets, what would a day without

space communication mean? Unfortunately, to find the answer to this question the “hard way” would be catastrophic, as people outside the space sector are often unfamiliar with the essential role that space and space technology plays in their society. They do not realise how much citizens depend on space communications, and this lack of awareness leads towards lack of support of space activities from the public. This is an issue explored in this paper, followed with recommendations to increase such awareness.

The working group implemented a coherent definition of space communications: Simply put, space communications can be characterised by the use of space technology to communicate around Earth via outer space, in order to enhance our daily lives. This definition of space communications is made to be universally understandable by people who are not related to STEM (Science Technology Engineering and Mathematics) education, or who are generally unfamiliar with space. The group also sought to implement a more technical definition into the basis of discussions: Space communications is a process of data transmission from a sender to a receiver via the use of an orbiting external medium, located in space. The data signal is modulated onto high frequency electromagnetic waves to act as the data carrier. This resultant wave is superimposed to form a modulated wave; this modulated wave has the efficiency to travel at the speed of light through space. Therefore, allowing data transmission to travel large distances, relayed through satellites in orbit, within very small time intervals.

Space communications, as previously mentioned above, plays significant role in our daily lives, not just as a technological marvel, but as a life necessity as well. It has made life on Earth productive and immensely safer in numerous ways. Space communications have provided humanity with numerous benefits. These benefits include, but are not limited to satellite navigation, long distance communications - particularly with rural regions, television broadcasting, weather forecasting, disaster management, search & rescue efforts, ground monitoring and tracking, and banking.

For example, communications satellites have contributed to a greater understanding and response of recent disasters. Figure 1 shows volcanic ash plume being tracked over Iceland in 2010 by Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on AQUA (NASA satellite), in order to restore air traffic operations in Europe.



Fig. 1: NASA satellite image depicting volcanic ash plumes over Iceland in 2010. Source: NASA¹



Fig. 2: NASA satellite image of the Hurricane Irene in 2011 being tracked to determine its exact location and the appropriate measures needed to be taken for response efforts. Source: NASA²

Satellite navigation systems continuously employ space communications in order to provide efficient and accurate positioning with the utilisation of GNSS (Global Navigation Satellite System) and other navigation systems, such as GPS (Global Positioning System). An example of satellite navigation using space communications is shown in Figure 3.

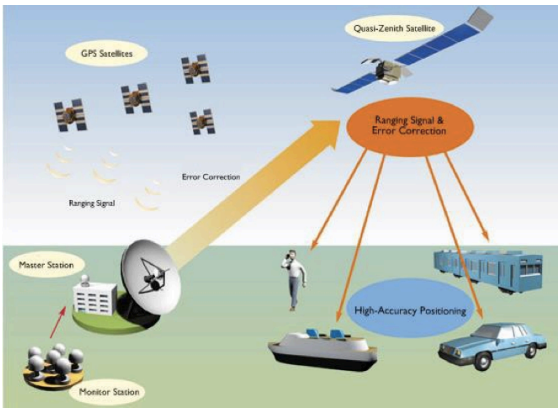


Fig. 3: Satellite navigation architecture. Source: WiFiNotes³

Other countries are also building their own navigation systems with use of satellites. Russia is initiating their navigation system called GLONASS. China is launching several satellites to build a better navigation system, called BeiDou. The European Space Agency (ESA) is developing a navigation system called Galileo, and India is also developing a system, called INSAT.

Through satellite navigation, both travel at sea and air traffic are made safer as well as trackable. Even apparently simple tasks, such as strolling around a foreign city as a tourist, would become much more of a trial without useful navigation tools, all supported and provided by satellite technology. Many offshore operations would be impossible without pinpoint satellite navigation.

If suddenly humankind were without these aids for navigation and communication, what would happen in our daily lives? Does the general public know that? These are some of the questions the Agency workgroup have stated and discussed. The group is acknowledging that only few people know what will happen, and how severe the consequences would be in a catastrophic event similar to this.

The key to understanding just how important space is in navigation and communication is to question what would happen if suddenly these tools were not available in our day-to-day lives. In the same way that space technology can make the distant seem local, it is essential to find a way to relate this question to the general public via a medium they understand and care about. The Agency working group has focused its efforts on addressing solutions to the existing gulf in public awareness.

Stories like “What would happen if all satellites stopped working?” by Richard Hollingham of BBC Future⁴ goes through some scenarios for a day where space communication suddenly is missing and what kind of impact will it have on the general public. The

goal of the Agency group is stated as “To identify an outreach strategy for a set of stakeholders to increase awareness of the benefits of space communication”. The reason for why the communication would fail lies outside the scope of our work.

II. OVERCOMING LACK OF AWARENESS

Space communication plays a role of utter importance for human society and our technologized world as previously mentioned. In the light of this, it is remarkable how little the public is aware of space communication and its benefits. In fact, the term, “space,” is associated by most people only with the achievements of human spaceflight, such as the Apollo missions to Earth’s moon, or the International Space Station. The connection between space applications, and in particular, space communications and services such as the weather forecasting or navigation systems are largely unknown to much of the general populace. Statements such as “What do I need weather satellites for, if I have my iPhone weather service?” or “I don’t need GPS satellites, I have a TomTom!” are common examples. Unfortunately, this lack of awareness across much of society has consequently a decisive influence on the public support for space related projects. Since progress in the form of new applications or research and development in the space sector is mainly driven by governmental funding, public opinion is an important factor. Therefore, efforts to raise awareness should reach people from all kinds of backgrounds, including different nationalities and age groups.

The SGAC working group identified the following primary stakeholders:

- The general public as users of applications based on space communications
- Space agencies
- Satellite service industry, including large communication satellite operators such as SES, Intelsat and Eutelsat
- GNSS consortium / software developers for navigational devices

Stakeholders are in many ways very similar in both government and commercial applications. As space communication is a necessity for humans in both peacetime and war, its applications and benefits are numerous. Inside the satellite business, satellite service providers are inflexible compared to satellite manufacturers. Satellite service providers commonly work towards long-term, continuing streams of revenue for the services they provide, whereas satellite manufacturers receive their revenues from distinct sales of hardware.

III. OUTREACH STRATEGY

The Agency group examined the stakeholders in space communications, which included the general public, space agencies, the satellite servicing industry, including large communication satellite operators, and GNSS consortia and software developers for navigational devices. Based on these findings, they developed a detailed outreach strategy. This included a definition of the content to be communicated to stakeholders, as well as the media tools to be used. Lastly, the funding strategy for the outreach plan was addressed. They concluded that an educational, dynamic, and integrated video, image, and game application campaign would be the most effective means of targeting and engaging stakeholders. This includes an interactive space communications game for smartphones, tablets, websites and onboard travel, which places the player in daily life situations without space communications; TV commercial spots for the game application; and an image of the evolution of space communications integrated across the video and game applications.

In order to achieve a successful campaign, seven basic brand concepts need to be addressed:

- Brand: This is more than just the logo; it showcases the experience that the person has with the company.
- Brand Association: These are the characteristics and traits that the brand name carries with it.
- Brand Name: The word(s) by which the company is defined as.
- Brand Personality: The emotional connotations of a brand.
- Image: A picture or animation the brand is associated with for visual reference.
- Location: Where a product or company fits in the current market.
- Catchphrase: A memorable phrase that is an expansion of the image.

We have briefly addressed these concepts, but look forward to future input on how these concepts may be addressed for the proposed campaign, beginning with the video campaign.

III.I Video Campaign

In the modern era, it has become even easier to engage, promote and spread information through the power of the Internet and social media. By harnessing this power, we can deliver a potent, informative and energy-packed message to the viewers. The video will encompass the uses of space communication in the daily lives of a city resident. And by terminating space communication, it will propose the implications

the resident would face in a 24-hour timeframe. A detailed drafted scenario can be viewed below.

As a City Resident

One would have no reception on his or her mobile, very few TV channels and radio channels, no weather forecasts, and no satellite navigation. This would expand to no Internet access, no ATM withdrawals, debit payments, or money transfers. Social activities that use high speed Internet connection would also be affected, for example, with one's local cinema having few movies, as the print is generally sent via digital format.

As a Nation

Long distance navigation would be impossible, causing major issues with ships and submarines, flights and equipped military forces. Information would travel very slowly, and there would be no instant broadcasts. International disaster management operations would be drastically affected. Defence related scenarios using UAVs etc. would be non-existent and scientific study from space would be slow, tedious, and nearly impossible.

In essence, without space communications, the human evolution would be set back not only couple of years, but a couple of decades!

III.II Image Campaign

The image is the visual aesthetic which portrays a campaign, delivering the message and renewing the kindled memory of the campaign message. It has been continually quoted that an image is worth a thousand words if it is correctly used. The image that will be chosen for this campaign should deliver the message of the transformation of space communication over time. The audience will be able to relate to this image effectively and can clearly see the progress and impact space communication has had on mankind.

This image would be used in all promotional aspects, and includes, but is not limited to posters, flyers, and website images. This will be the first point of contact for the viewers to interact with the campaign. In order to maintain and drive the campaign momentum, an image competition will be launched to customise the original campaign image to be used in the app development process. This will be our first source of public engagement and act as a verbal initiative for information to be spread through word of mouth. The competition submission will be handled online through a dedicated website. This type of submission will have five key benefits for the campaign:

1. It reiterates the importance of space communication.

2. It allows constraints and boundary conditions to be set on the image(s) submitted.
3. It is an efficient way to view the submitted images.
4. All images can be showcased to a wider audience.
5. Can be used as a judging tool for the submitted images using public feedback.

In the proposed outreach plan, the image campaign offers a great opportunity to attract the broad public and raise awareness among wide groups of people, including people not initially interested in space. The open competition concept using a voting system would play a significant role with respect to this. First, it is free to anyone to submit an image design and second the public opinion expressed by user votes will decide on the competition winner. Consequently, the artist him/herself, as well as friends and acquaintances would advertise the image. This would take place in combination with social networks, which are a powerful media to gather public interest and create an enormous momentum. Examples could be the sharing of invocations for support, which spread through social networks such as Facebook and Twitter. Through this method, large networks of people may be addressed. As the momentum and public attention of the campaign increases, the number of artists interested in participating in the competition will increase. Since the final selected image is going to be used in all promotional aspects of the campaign and thus will be very prominent all over the media, the career of an artist will greatly benefit from such publicity. This is not only valid for the winning artist, but also for competitors that are not selected as the final image. Depending on the funding of the campaign, attractive prizes such as a space tourism flight or a trip to a rocket launch could be awarded.

The following image was designed by the working group during the Space Generation Congress 2013 and gives a first impression of the type of image that would be suitable for the campaign.

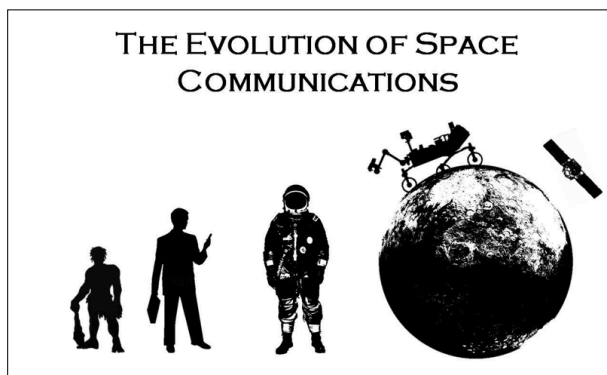


Fig. 4: “The Evolution of Space Communication” proposed sketch for image campaign.

III.III App Campaign

As mentioned before, the main concept of the proposed outreach strategy is to target and attract the attention of the audience. The app campaign will act as the main source of interaction with the viewer and become the base principle driving our campaign.

Consequently, the development, distribution and operation of this mobile application are important points for the proposed outreach plan. The application shall emphasise the importance of space communication in our daily life and at the same time, be attractive for a large group of users. Therefore, an educational game is proposed. With respect to this, it is crucial that the game principle is fun to play and at the same time addictive, in order to be able to compete with other applications on the market. Further requirements will be distribution at no charge. A high compatibility with user devices can be achieved by using HTML5 or similar based configurations primarily used for mobile phones, tablets, and Internet browsers. Both requirements will facilitate and foster the distribution and wide usership among the target groups.

An imaginable basic idea for the game principle would be to allow the player to act as the head of a world organisation tasked with maintaining the global satellite systems, whilst facing a variety of challenges and crisis situations. The latter could include management aspects in the form of budgetary constraints, space weather occurrences, space debris impacts, and a satellite’s end of life and replacement by new launches to name just a few possible game aspects.

The working group has considered two main concepts for the app development. The first and preferred solution would be to recruit leading developer companies and firms designing mobile applications, with particular mobile games as Rovio Entertainment Limited (Angry Birds)⁵ or Gameloft S.A. (The Settler iOs/Android). The second and alternative possibility would be to invite software developers to an international, open app design competition. Similar projects have been successful in the past, such as the NASA International Space Apps Challenge⁶ and the Global Game Jam.⁷ In line with this concept, it is necessary to provide the developers with information and specific requirements to be fulfilled in the mobile application. Furthermore, it is important to facilitate the programming process with participating design teams and to provide them with support. At the same time, creative liberties must be given to the developers, as they would not be granted major funds, with competition relying on their motivation and enthusiasm. Again, the winning team would be awarded with positive publicity. Additionally, the team could be

awarded attractive prizes similar to the proposed strategy for the image competition.

The game principle and its implementation are vital to the success of the app campaign. In examining both proposed options, the preferred solution would be to hire an experienced and well-known developer team in order to create the application. By choosing this option, the developed product would be particularly promising with respect to appealing to the app users' demands. Furthermore, it would be easier for the campaign leaders to strongly influence in the design process.

III.VI Campaign Road Map

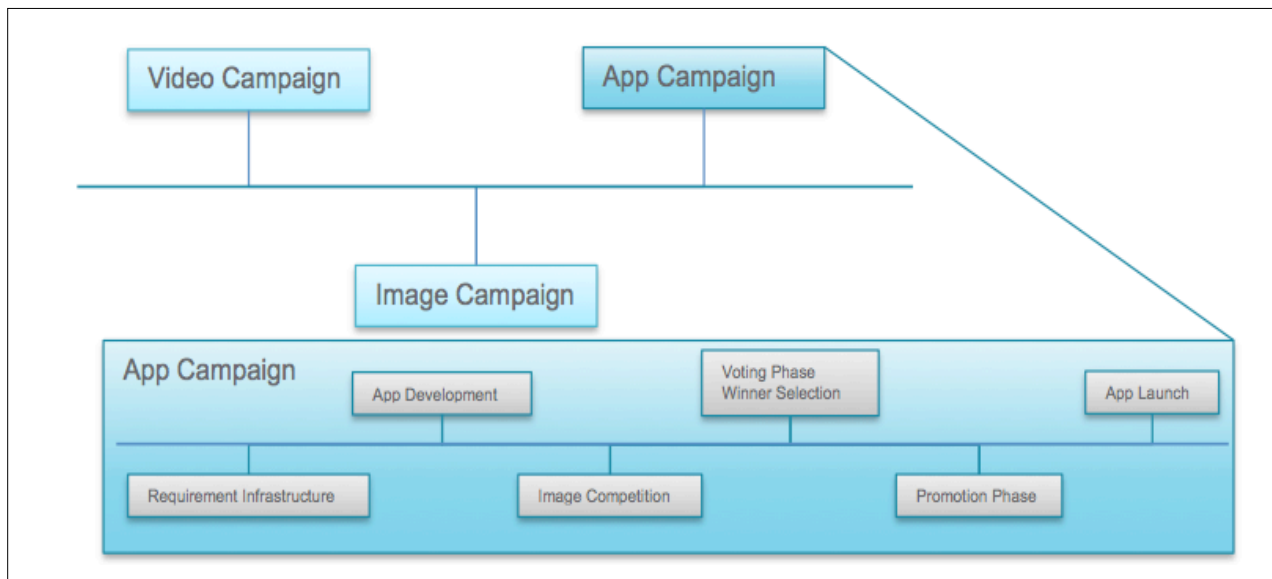


Fig. 5: The Proposed Campaign Roadmap⁸

A brief “App Campaign” Roadmap is characterised by six phases:

1. Requirement Infrastructure
2. App Development
3. Image Competition
4. Voting Phase/Winner Selection
5. Promotion Phase
6. App Launch

III.V Collaboration and Funding Strategy

In order to achieve the goal of the working group, a collaborative and joint approach with space agencies, industry, and non-governmental organisations (NGOs) is considered. As satellite communication is not limited to a certain region or continent, but continues to be of global significance, its promotion shall be conducted on the same scale. This means all parties in the communication business shall be able to benefit from the outreach strategy and be active

participants. In order to coordinate a neutral outreach strategy, is the working group proposed to utilise an NGO – specifically, the Space Generation Advisory Council (SGAC). SGAC could act as a neutral coordinator of the outreach strategy with various agencies and companies. Through this method, organisation and implementation could be maximised, and conflicting interests minimised.

With respect to funding, the proposed strategy could be combined with existing campaigns such as the UK Catapult “Future Cities”,⁹ NASA’s International Space Applications Challenge¹⁰ and with manufacturers of end user equipment. The first two campaigns offer challenges for citizens to solve different problems by

providing ideas and concepts for space communications outreach on a competitive basis. By partnering with the aforementioned campaigns, participants may draw from such competition models in order to provide further input for the proposed outreach campaign.

Collaboration with manufacturers of certain hardware, such as GPS receivers, would mutually benefit the outreach participants and the manufacturing company. Outreach participants would offer the company wide advertisement of their products, companies would provide support for outreach strategy.

Another aspect to consider for the collaboration strategy is the general advertising and localisation of outreach efforts. Awareness may be brought directly to the audience by taking into consideration local culture and advertising strategies. For example, Chinese public transportation TV screens present video campaigns about “China in the Future,” promoting local and national socioeconomic plans. Similar campaigns, such as those for the Red Cross also granted cost-free advertising space in German subway stations with high passenger traffic. This may be considered as an

additional opportunity if the proposed strategy is coordinated by an NGO. Additionally, an emphasis on educational outreach by bringing the apps to schools, and teaching the pupils and teachers how to use it is may be considered as a more effective means of localising advertising.

Overall, the space application is a billion-dollar revenue industry per year (\$180Bn in 2011 and 350 BN in 2013^{11,12}). The proposed campaign is a slim line strategy for increasing space awareness for them. Garnering outreach campaign support from service providers alone is considered plausible. The strategy is also divided into several short, medium, and long term efforts, as this would provide an interesting chance of return on investment if stakeholders, such as satellite communications providers, were to consider participating in the short term efforts presented in the group, thus establishing a basis for medium and long term outreach phases.

III.VI Candidate for Strategy Commissioning

In addition to the general strategy and the stakeholders, the research determined a promising candidate for the commissioning of the strategy. The Galileo Global Navigational Satellite Service is expected to be functional in 2019.¹³ Galileo offers its services and products to space agencies (ESA), industry (Astrium, OHB), government (mainly European countries) and the general public. With the deployment of this GNSS service, the Galileo Consortium may utilise the proposed strategy outlined in this paper to provide information with respect to Galileo and satellite communications to end users. End users who purchase handheld navigational devices for use in their cars and mobile phones will be ideal recipients. These devices already possess displays and are multimedia devices that can also be used to display additional information than just the local position and route information such as music and videos. So the proposed video of this strategy can be played when the device boots up or an animation can be shown when the route is calculated showing that the position is calculated with help of satellites. One possible way is to zoom out from the last position on ground to one that shows the Earth and Galileo satellites in orbit and another zoom back when the route is ready. Both techniques are considered as simple to implement and can have an effect to illustrate the importance of space in the lives of the general public. This can be more efficient than just a “made for space” label as it was proposed by the Agency working group during SGC 2011 and can be combined for this strategy as well.

IV. CONCLUSION

We are convinced that Space communication is an essential and familiar thing. And also we notice that few

people know about it. It needs more and more people knowing the necessity of Space communication. We discussed about outreach plans and so, we suggested some outreach campaign such as video, image, app as effective way to disseminate information.

It has been proven in this paper that satellite communication is important to mankind and acts as the support anchor for a wide field of applications. We have noted that the lack of awareness in regards to this can be detrimental to funding and support. This in turn will affect the normal day-to-day workings of mankind as the modern age is connected to fast paced communication systems. We have concluded that the best way to spread information to the wider audience and to solve this problem would be through an outreach campaign. This campaign would involve three sub-campaigns, namely, video, image and app. Through these three sub-campaigns, we will be able to promote the importance of space communication and generate interest and understanding on how these satellites improve and cater to our daily needs.

V. RECOMMENDATIONS AND FUTURE GOALS

The group recommended that the most successful means of integrating this video, image and game campaign would be by utilising a neutral coordinating organisation, such as SGAC, when facilitating stakeholder outreach in the working group members' respective countries. The group recommended collaboration with existing outreach campaigns, such as NASA's International Space Apps Challenge and UK Catapult "Future Cities" as strategies for funding. They recommended that the outreach strategy be divided into several short, medium, and long term efforts, as this would provide an interesting chance of return on investment if stakeholders, such as satellite communications providers, were to consider participating in the short term efforts presented in the group, thus establishing a basis for medium and long term outreach phases.

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