Managing Non-Traditional Threats by Using Space Technology: A Case of Pakistan

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Abstract
Since 1957, the progression in space-based technology has opened more avenues for the peaceful application of space. Non-traditional threats originate from multiple sources of natural causes and affect a State's population and its relevant institutions. In this realm, satellites play a vital role in dealing with such threats. The South Asian region is also victim to traditional as well as non-traditional security threats. Similarly, Pakistan is facing numerous non-traditional threats which primarily threaten its socio-economic security. Such challenges are diverse including their spiral nature from one state to another specially with environmental hazards, water and food security and aggravating population growth with increasing social disparity over distribution of resources. Pakistan has signed many agreements in the field of peaceful uses of space technology. Pakistan's space program highlights the use of space technology in different domains including agriculture, health, education, disaster management, environment, climate change, land planning, coastal and marine resources, geology and mineral prospection. With the peaceful application of space technology, Pakistan is determined to enhance its national infrastructure and is ready to meet and curb the emerging non-traditional threats to its national security. With regards to the peaceful use of space and threat management, this paper discusses the areas wherein Pakistan is using space technology to deal with these threats and analysis the issue of space militarization.

Keywords
Space technology, SUPARCO, Pakistan, non-traditional threat

Introduction
The dynamic nature of national security has been evolving since Post-Cold War era. National security is aimed at defending borders, territorial integrity, sovereignty and population of a state against traditional and non-traditional security threats (e.g., Bailey, 2005). In the 21st century, the issue of national security expanded to the emerging challenges of the non-traditional security threats. The concept of traditional threats may refer as conventional threats particularly emerging against population and government from other states' civil and armed forces institutes. On the other hand, non-traditional threats originate from multiple sources of natural causes and affects the state's

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population and its relevant institutions (Bailey, 2005; Kicinger, 2004). The traditional school of thought on national security focused on defining origin of threat perception of a state from respective opponent state only. With the passage of time, the additional concerning threats that are categorized under non-traditional also known as Copenhagen school, threats include: military, societal, political, economy and environmental security. In this regard, the Copenhagen school of thought defines associated risks from environmental degradation as a future challenge for the world (Trombetta, 2006; Smith, 2017; Rucktäschel & Schuck, 2018; Pavlović, 2017).

The South Asian region is victim of many security threats arising from traditional as well as from non-traditional security threats. Non-military threats includes increasing population rate, illegal immigrants, poverty, social disparity, terrorism, arms trafficking, environmental hazards and illegal transfer of money are the extreme challenges in the region. All in all, there is no role model to follow in South Asia for effectively dealing with these challenges except to dedicate all states' efforts towards cooperative security mechanism to alleviate these mentioned challenges in near future. Considering the challenges in securing food and water means, the growing prices are pushing for a change in existing policies especially in domain of agriculture. Among other factors, there are million people who cannot afford high food prices due to their low income and daily wages salary. Another issue of insufficient division of resources among people has also added problems for human security domain. In a longer run, these issues will worsen the socio-economic and socio-political challenges.

The health security is another domain that faces crucial problems in South Asia. A large chunk of people is still living without pure drinking water and proper sanitation systems. This factor was not considered as a security threat until United Nations (UN) sponsored a resolution of AIDS that causes hazards or human security. In India, in particular, there is growing number each year of AIDS patients and it poses a threat to the region as India has the largest population among all states in the region (Feldbaum et al.,2006; Elbe, 2006; UNAIDS, n.d.). Their cross border travelling expands the scope of threat to other states that should not go unnoticed.

In addition, the South Asian region is also facing grave nature of natural calamities that resulted in huge loss of human and economic resources. Such natural tragedies have caused growing number of floods, water scarcity, air pollution, increasing population and uneven distribution of scare resources etc. An alarming changings in environmental deprivation can further result in extreme weather changes, glaciers melting, floods and epidemics. Pakistan is also affected by all these changes in the region. Such nontraditional security challenges have offered implications on its economic progression and socio-political stability. Pakistan needs to pay an attention to these challenges that have detrimental effects on its population and further deprives the human and economic resources in future.

The hazardous effects of earthquakes, floods, droughts, storms and cyclones are aggravating in Pakistan. The worst case example in literature was of 2005 earthquake damages that have caused 0.1 million deaths, inflicted devastation for 20 million people and suffered $5.2billion financial losses (e.g., Buttenheim, 2010; Hamilton & Halvorson, 2007). Besides, extreme weather changes and changing patterns in raining seasons have influenced the agricultural sector and less supply in food sector. Water and food scarcity are another emerging challenge for Pakistan in nontraditional security domain. Inter-state water wars is also a well debated issue between Pakistan and India in future that offers repercussions for human security as well (Khalid, 2010; Hill, 2013; Miner et al., 2009). Therefore, above highlighted security threats in nontraditional domain are significant to address for peace and

stability of Pakistan. There is an urgent need to have a proper mechanism to deal with the issue and to educate people and policy makers about it. Cooperation should be made both at national and international level.

The Cold War era has marked the evolution in space technology as a power hegemony in space. Former Soviet Union launched its first satellite in space, Sputnik in 1957 (NASA, n.d.). U.S. pursued the same path and landed its first moon mission as Apollo Mission in 1969[3]. After that many states started their space programs in order to achieve maximum out of it (Peter, 2006).

Space is a global common for peaceful activities by all. Like many other states, Pakistan has shown its interests in technological advancements in peaceful uses of space. The assessment and efficient evaluation of environmental studies have used the space expertise of remote sensing satellites around the world. Climate change has a deep impact on triggering environmental problems such as cyclones, floods, wild fires, tornadoes, droughts, earth quakes, volcanoes etc. With the help of remote sensing technology, the study of extreme weather changes and features of climate change have enhanced the capability of timely and effectively responses. It has helped to improve the human and mechanical simulations for reducing the dangerous outcomes.

Advantages of Remote Sensing Satellite (RSS)

Remote sensing technology is famously defined for assessing data related to any object or phenomena without any physical intervention or diversion (National Ocean Service, n.d.). This technology has been used in fields of geology, forestry and many more. The most efficient use is in studying the risk factors and provide the timely input for policy makers to address the forecasted challenge. The active remote sensors usually operate in a microwave portion for penetrating into an electromagnetic spectrum. Whereas the passive remote sensors deal with the infrared, thermal infrared and microwave potions for scanning the recorded data (NASA Earth Data, n.d.).

A range of studies have highlighted the importance of remote sensing in catastrophe controlling measures. One of the major advantages of the Remote Sensing Satellite (RSS) is its ability to provide and access information before and after the natural disaster. First, in pre-disaster phase, RSS can be used to identify and develop system and resources before it occurs (Bello et al., 2013). It is aimed at ensuring that response to disaster is efficient and well managed. Digital terrain data is also used for hydrological and flood modeling (Vorovenchii, 2011).

The world class studies have shown that with the help of RSS an efficient study can be conducted for assessing the future environmental hazards. RSS has a capability to capture an image of a huge land that are beyond human reach. They can provide a high tech analysis and one can retrieve data from the system after many years too (Vorovenchii, 2011).

Pakistan and Space Technology

Pakistan can also effectively work against averting the highly risked consequences from natural disasters with the advancements in technical and human resources. With regards to climate change, Pakistan needs to indigenously work for mapping the extreme changes and study its impact over the year. Then, an effective future strategy can be drawn to curb such challenges.

[3] For details regarding 1969 Moon Landing, please visit: https://www.history.com/topics/space-exploration/moon-landing-1969.m

Pakistan's Space and Upper Atmosphere Research Commission (SUPARCO) was formed back in September 1961. SUPARCO works for the research and development of the peaceful application of the space technology. It is intended at advancement of socio-economic development of the country by using space for dealing with weather forecasting, remote sensing, natural disasters, mapping, environmental monitoring, climate changed, etc. Pakistan first independent communication satellite was launched from the Chinese base on July 16, 1990. Pakistan launched it geostationary satellite in 2002 named PakSat-1.[4]

Later in 2010 with modifications, PakSAT-1 was replaced by satellite Paksat1R. Pakistan also has multiple earth observational satellite such as Badar-B. Pakistan is the first country to use China based Global Positioning System (GPS) civilian use. It can provide accurate positioning. It will be used to develop backward areas, traffic monitoring and other disaster relief measures.[5]

International Collaborations

Considering Pakistan's collaboration at international level, Pakistan has signed many MoUs and agreements related to the peaceful use of space with China, European Union, France, Russia, Saudi Arabia, Syria, Thailand, UK and the U.S.[6] Pakistan has also ratified the UN General Assembly sponsored legal measures for the peaceful use of space including Outer Space Treaty (1967), Rescue Agreement (1968), Liability Convention (1972), Registration Convention (1975) and the Moon Agreement (1979).[7]

SUPARCO is associated with various international institutions for conducting joint Research and Developments (R&Ds) in exploring peaceful use of space. These R&Ds activities comprises on exchange of data, training and organizing seminars and conferences on the space related activities. Pakistan is an associate member of Asia-Oceania Space Weather Alliance (AOSWA). This regional platform encourages states to develop R&D on space weather issues in Asia and Oceania region. AOSWA members exchanges both real-time and archived data for computer simulations, geomagnetic and ionospheric observations.[8]

SUPARCO is also a member of Inter-Program Coordination Team in Space Weather (ICTSW). This program aims to design collaboration between world's space services and meteorological organizations of different Western, Asian and European countries. It helps to gather up-to date weather information and provides an opportunity to interact with world space community.[9] Furthermore, Pakistan has acquired new Digital Portable Sounder model-4 from University of Lowell, U.S. and it is operational since 2008 at Multan. Previously, Pakistan received three Digisondes model- 256 at Sonmiani and Islamabad in 1980s. Further, it is also seeking expertise on ionospheric study since 1987 from the U.S.[10]

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[4] For details on the history of SUPARCO, please visit: http://www.suparco.gov.pk/pages/history.asp
[5] Ibid.
[6] For details on International Cooperation in the field of Space Sciences, please visit: http://www.suparco.gov.pk/pages/agreements.asp
[7] Ibid.
[8] For details on Asia-Oceania Space Weather Alliance, please visit: http://www.suparco.gov.pk/pages/aoswa.asp
[9] For details on Inter-Programme Coordination Team on Space Weather, please visit: http://www.suparco.gov.pk/pages/ictsw.asp
[10] Ibid.

Two operational geomagnetic observatories at Islamabad and Sonmiani are installed with the cooperation of Royal Meteorological Institute, Belgium. Pakistan has also received assistance from British Geological Survey for upgrading Karachi geomagnetic observatory with the regular exchange of information. On area of environmental impact, SUPARCO is associated with the European Commission's project on assessing energy observation for monitoring the related environmental impact of energy usage. Pakistan is also desiring to develop joint R&Ds in areas of glaciers study and its monitoring in different climate changes with Chinese Institute of Tibetan Plateau Research (ITP).[11]

Food and Agriculture Organization (FAO) is in contact with SUPARCO for providing the status of Pakistan's fisheries resources and also interested in developing capacity to national fisheries research and management institutions like Pakistan Marine Fisheries Department (MFD) is also a member of the UN Economic and Social Commission for Asia and the Pacific (ESCAP) - Inter-Governmental Consultative Committee (ICC) that advances the successful implementation of the regional space programs.[12] SUPARCO scientists also participate in its Regional Working Groups (RWGs) on Space Science Technology and Applications (SSTA), Satellite Communications (ComSats), Remote Sensing and GIS (RS/GIS) and Meteorological Satellite (MetSat) Applications of UN ESCAP dealing with the regional space science and research activities.[13]

The Committee on Space Research (COSPAR) provides an opportunity to the Pakistani scientists to share their papers in its preliminary meetings. COSPAR is famous for offering opportunities of cross-fertilization of new ideas for research in space domain.[14] SUPARCO is also dealing with the International Society for Photogrammetry and Remote Sensing (ISPRS) for developing avenues for the application of the Photogrammetry and remote sensing technologies in Pakistan.[15]

Pakistan's National Coordination Committee is established for the implementation of the Satellite-aided Search and Rescue COSPAS-SARSAT Program in Pakistan. The Committee drafts the legislative concerns related to emergency distress services and provides monitoring aspects in accordance with the needs of the International Maritime Organization (IMO), International Civil Aviation Organization (ICAO) and International Telecommunication Union (ITU).[16]

SUPARCO is a member of American Institute of Aeronautics and Astronautics (AIAA). Their membership helps them to study and assess the diverse literature on recent developments in space science and advancements through provided technical books.[17] Pakistan is also a member of International Astronomical Federation (IAF). IAF explores the peaceful usage of technical information and simulate the public interests in space issues through mass communication. SUPARCO Chairman also

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[11] Ibid.

[12] For details on Food and Agriculture Organizations, please visit: http://www.suparco.gov.pk/pages/fao.asp

[13] For more details on United Nations Economic and Social Commission for Asia and the Pacific, please visit: http://www.suparco.gov.pk/pages/un-escap.asp

[14] For details on Committee on Space Research, please visit: http://www.suparco.gov.pk/pages/cospar.asp

[15] Ibid.

[16] For details on National Coordination Committee for COSPAS-SARSAT, please visit http://www.suparco.gov.pk/pages/cospar-sarsat.asp

elected as a member of IAF for Liaison between International Organizations and Developing Nations.[18]

Pakistan is also associated with the Asian Association for Remote Sensing (AARS) that promotes the sharing of the information and goodwill on Remote Sensing among Asia-Pacific states. Participation in AARS programs relates with the scope of SUPARCO. It also provides an opportunity to deliberate on cross-cultural issues related with emerging technological developments in space.[19]

Pakistan, China and Thailand are considered one of the founding members of the Asia Pacific Space Cooperation Organization (APSCO). APSCO aims to enhance cooperation in peaceful use of space. The APSCO Convention, according to Article-9, "shall enter into force when at least five (05) States have signed it and deposited with the host Government (China) their instruments of ratification or acceptance". [20]

Furthermore, the Inter-Islamic Network on Space Science and Technology (ISNET) is working with Organization of Islamic Countries (OIC) Standing Committee on Scientific and Technological Cooperation (COMSTECH). ISNET is functioning within SUPARCO's head office in Karachi. ISNET is involved in outreach activities for gathering policy experts, scientists and engineers from the OIC member states on exploring peaceful uses of space.[21]

Pakistan's National Mission towards Remote Sensing Satellite

SUPARCO is now on its mission to develop Pakistan Remote Sensing Satellite to meet national and worldwide requirements in satellite imagery. Pakistan was the first country to launch its space programs in South Asia. Pakistan's space policy is focused on peaceful use of outer space for the sake of socio-economic development of the country. Likewise, the Pakistan's space policy also stated "space as a strategic sector, exploit all aspects of space science, technology, and its applications for national well-being". [22]

In July, 2018 two satellites of Pakistan were launched from China. At an altitude 640 km, Pakistan Remote Sensing Satellite-1 (PRSS-1) is operating in sun-synchronous orbit. This satellite is helping Pakistan in meeting its imagery requirements in different domains such as land mapping, agriculture, town planning, and environmental monitoring, disaster and resource management for the welfare of state.[23]

Second satellite known as Pakistan Technology Evaluation Satellite-1A (PakTES-1A), is an indigenous effort. It is 285 kg Remote Sensing Satellite (RSS) of Pakistan, launched at 610 km sun-synchronous orbit. This venture has enabled the scientists and engineers of Pakistan to explore new avenues for developing Pakistan's space program.[24] On the basis of propagated signal, the RSS technologies are being widely used to identify and categorize objects on Earth, including on the surface, atmosphere and oceans. PRSS-I is helping Pakistan in better assessment of changing weather patterns and hence its better management at different levels.

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[18] For details on Asian Association for Remote Sensing, please visit: http://www.suparco.gov.pk/pages/aars.asp

[19] Ibid.

[20] For details on Asia Pacific Space Cooperation Organization, please visit: http://www.suparco.gov.pk/pages/apsco.asp

[21] For details on Asia Pacific Space Cooperation Organization, please visit: http://www.suparco.gov.pk/pages/isnet.asp

[22] For details on National Space Programme, please visit: http://suparco.gov.pk/downloadables/nsc1.pdf

[23] Ibid.

[24] Ibid.

After air, water is another important element of eco-system but unfortunately, it is becoming a depleting resource and serious concern due to ever rising demand. Water scarcity is alarming for Pakistan for obvious reasons such as agro based country, huge population, urbanization, climate change and decreasing level of precipitation, and the accelerated retreat of Himalayan glaciers. Moreover, the Indus River System has been severely affected due to decrease in average rainfall universally. According to the World Resource Institute, by 2020 Pakistan will face a major challenge with regards to supply and demand of water (Luo, Young & Reig, 2015). Moving further, by 2030, it will become more challenging thus adding Pakistan among those countries who are facing immense water stress (see Figure1).

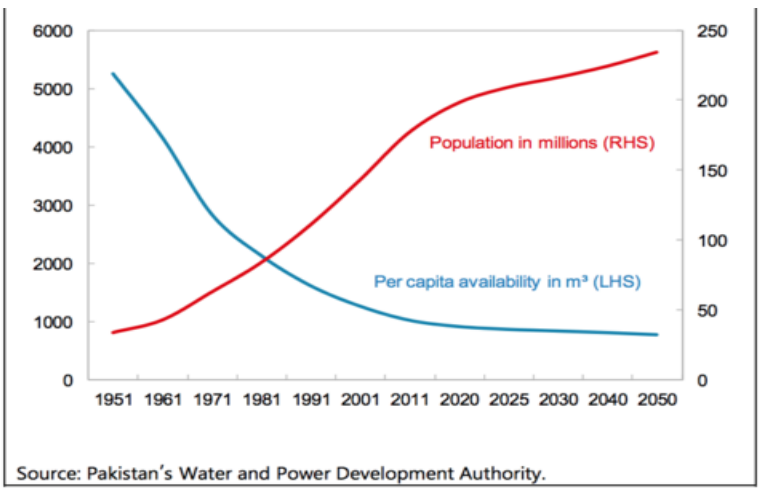

Figure 1: Pakistan: Water Availability (m3/person)

One of the major reason for inadequate water management is the lack of consensus at national level with regards to mega projects such as construction of dams. The research by World Bank is of the view that Pakistan is moving from water stressed to water scarce country. Water is a central element when it comes to power generation, agriculture, domestic use, industrial use and is being used extensively without taking into account effective management mechanism. India's aggressive posture against Pakistan is known to all, especially when it comes to water issues. They have been talking about Indus Water Treaty being obsolete and terminating it. They are inhabiting of linking it with the situation in Occupied Kashmir, if this is not resolved, it would further intensify the complexity.

It is estimated that by 2025 the population of Pakistan will be around 250 million (Worldometer n.d.). This population explosion will further intensify the challenges faced by Pakistan especially, it will reduce per-capita water availability. As Pakistan is agriculture based country, thus water shortage will have serious implications in socio-economic domains. In order to deal with these threats, SUPARCO has been making efforts such as development of geospatial systems for better irrigation regulations, glaciers mapping and monitoring, river and flood vulnerability assessment, crop damage assessment, sea water intrusion mapping and ground water prospection..

The United Nations Office for Outer Space Affairs (UNOOSA) and SUPARCO conjointly arranged "the United Nations/Pakistan International Workshop on Integrated Use of Space Technologies for Food and Water Security (UNSPIDER, 2013). The Workshop was aimed at analyzing how space could become a valuable domain for socio-economic development. It is primarily focused on food security and water management in developing countries.

In 2018, fourth "International Conference on the Use of Space Technology for Water Management organized by UNOOSA, SUPARCO on behalf of Pakistan, the Prince Sultan Bin Abdul Aziz International Prize for Water (PSIPW), Saudi Arabia and Inter-Islamic Network on Space Science and Technology (ISNET) was held at Islamabad" (UN Office for Outer Space (2018). The main objective of the conference was to engage and exchange technical knowhow of various technologies for peaceful use of outer space in dealing with prevailing challenges. The first such event, the United Nations/UNESCO/Saudi Arabia International Conference on the "Use of Space Technology for Water Management", was organized in Riyadh, Saudi Arabia, in April 2008, the second conference was organized in March 2011 in Buenos Aires, Argentina and the third one in Rabat, Morocco in April 2014 (UN Office for Outer Space (2018).

As Pakistan is facing immense challenges to deal with non-traditional threats, PRSS-I is being utilized for remote sensing which means monitoring the water temperature and color. RSS can help in better assessment of quality and quantity of water demand in various areas of Pakistan which are different to locate physically. RSS provides information about the surface area of water bodies in different seasons. PRSS-I could be utilized for the weather forecasting to predict the natural disasters like floods, rains, storms, etc... It can also assist in making a better crisis management plan. Pakistan is an energy deficit country, it needs effective mechanism to deal with it. Electricity demand, supply and generation can also be met by timely weather forecasts. Once the electricity problem is resolved, it would help to reduce the economic and social costs of managing disasters and electricity demands of Pakistan significantly. Data related to past and current weather can assist in future predications and decision making as well (Grind GIS, 2018). The spread of several chronic diseases can also be analyzed data collected through satellites. It ensures health and recovery of common public. Remote Sensing also helps in agriculture sector. It provides data about crops classification and provide better opportunities for the production (Vinciková, Hais, Brom, Procházka, & Pecharova, 2010). As Pakistan's economy is largely based on agricultural products hence, remote sensing assist in overcoming major hurdles. Accurate agriculture reporting system is of great significance when it comes to

production. Remote sensing technology is being used to forecast the production of crops and yield over a specific areas, which determines the quantity of crop harvested under different circumstances. It assist researchers to make a fair prediction about the quantity of crop. This technology can also be used to assess crop progress and timely precautions. It can exactly determine the amount of crop which has been damaged and the progress of the rest. It can also help in estimating acreage of farmland. It is very time taking and burdensome procedure if it is carried out manually because of size and other issues but remote sensing has make it more feasible. Remote sensing technology helps in identifying pests in farmland and plays a significant role in getting rid of the pests and diseases on the farm. Another important feature of this technology is that it provides data about the soil moisture. This information is then used to determine whether a particular soil is moisture deficient or not and helps in planning the irrigation needs of the soil. Moreover, soil mapping is one the most common yet most important uses of remote sensing technology. Remote sensing helps in the identification of soils which are not suitable for crops.

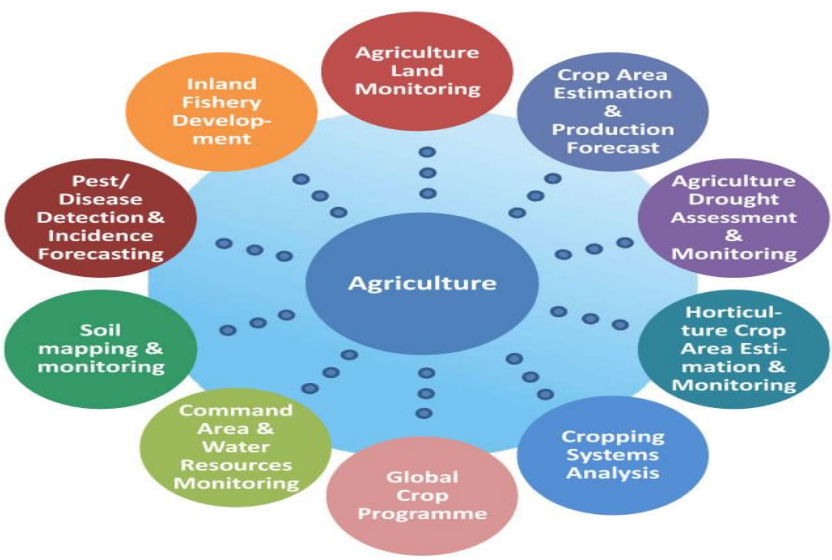

Figure 2: Remote Sensing Technology and Agriculture

Pakistan's Stance

Dual use technology can prove to be a blessing as well as curse. Though technology can tackle many problems faced by mankind but they also come with negative side effects. Pakistan is against the weaponization or militarization of outer space. The permanent representative of Pakistan to the UN has called for peaceful use of outer space and expressed that Pakistan is strictly against the weaponization of outer space.

As it is a global common so it should be strictly used for socio-economic welfare of human beings (Amil, 2018). Space militarization leading to weaponization will have serious repercussions globally.

Pakistan is also a strong advocator of Prevention of Arms Race in Outer Space (PAROS) and on declarations on "no-first-placement of arms in outer space." Likewise, Pakistan also supports non-legally binding International Code of Conduct for Outer Space. Keeping in view all these initiatives Pakistan has timely called for Confidence Building Measures in space at various forums to deal with any misperception (Janjua, 2017). Hence, efforts should be made universally to keep space out of arms.

Way Forward

Pakistan has been collaborating with many states on peaceful use of space technology. The significance of nontraditional security is another important area that needs an attention. As mentioned above, the use of space technology for mapping weather changes and assessing environmental hazards is under observation by many international institutions. Pakistan should also continue to initiative and propose regional and international collaborations on spiral effects of nontraditional security. At international level, many international organizations including UN are working to improve the interstate coordination for overcoming the nontraditional security challenges in future. The UN Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) coordinates the different regional workshops for facilitating technical help to states (Lewis, 2011). Pakistan can become a part of this organization for further improving its expertise related to catastrophe controlling.

At national level, Pakistan's Space program highlights use of space technology in different domains including agriculture, health, education, disaster management, environment, and climate change, land planning, coastal and marine resources, geology and mineral prospection. With the application of peaceful use of space technology, Pakistan is determined to enhance its national infrastructure and ready to meet and curb the emerging nontraditional threats to its national sovereignty. Pakistan understands the dynamics of the nontraditional security that can also be improved through interstate collaborations. Pakistan offers revenue to many states to share their technical expertise and advances Pakistan's national infrastructure towards achieving common goals for excelling in innovative and state of the art application of peaceful uses of space technology.

Keeping in view the prevailing strategic environment, Pakistan should work towards indigenization of its national space program. It will help in future to deal with an increasing demand from civil sector with respective to their advance communication means linked with GPS, mobile telephony and the internet. SUPARCO should be given desired attention by the policy makers. It will lessen Pakistan's reliance on foreign satellites in civilian domain. Pakistan should also aim for indigenization of space science technology and gradually incentivize its human resource towards meetings its missioned goals. Through enhancing international collaborations, Pakistan should continue to provide an exposure to its human resource through sharing of space based knowledge. Different media workshops, joint international seminars and conferences are the useful ways towards creating an awareness of Pakistan's peaceful efforts in use of space technology. A robust and sustainable space program is significant for country's economic gains as well.

Pakistan should grasp an advantage for expanding its businesses and other economic sectors with the help of peaceful side of the space domain. It should work

towards investing more in its space diplomacy internationally. This can also enhance Pakistan's foreign policy with other states and will develop more areas of cooperation by projecting its enhanced means of soft power in space (Arif, 2018).

Conclusion

Pakistan is fully determined to fight the nontraditional security threats by using space technology. In this regard, Pakistan's Remote sensing technology is aimed to play significant role in disaster management especially during the awareness and reaction phases. Space technology could provide not only cost efficient and effective methods of water management but also accurately monitors and predicts long term trends of depletion of resources.

Pakistan is also willing to purse such cost effective ways through peaceful application of space technology. Pakistan's active participation is appreciative at various international institutions but its decade's old dedication and determination needs to be highlighted nationally and internationally. Pakistan's space program expresses Pakistan's interests in advancing innovative technical means in space technology. It also incentivizes its efforts towards advanced states for endorsing the international collaborations on understanding the peaceful application of space.

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