Maximizing Benefits of Space Technology for Nepalese Society

Toya Nath Baral
Director General, Survey Department, Nepal
tnbaral@ntc.net.np

Ganesh Prasad Bhatta
Survey Officer, Survey Department, Nepal
gpbhatta73@hotmail.com

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Abstract

Advancements in the space technology have contributed to the human life considerably. The technology has been exploited for making human life easier and more secure in large extent. Space technology application for managing unavoidable natural disasters, human induced disasters and other societal problems/situations is one of such examples. Space technology application has brought the possibilities of real time mapping of disasters and its on-time management. Application of space technology in Nepal was brought into practice during 1970's. However, it has been realized that institutional infrastructure is yet to be developed to exploit the technological advancement of space technology. Survey Department is the leading organisation for launching space programs in Nepal. The department is working with collaborative approach with various organization to utilize the space technology information for the development activities in Nepal so that the benefits could be maximized for the society.

This paper tries to highlight on the state of the art of the space technology application in the country, the potential areas for maximizing space benefits for the society, the challenges to cope with the space technology applications and the area of regional cooperation required to enhance the space programs of the country .Lack of human resources and necessary infrastructures are the main constraints in Nepal for launching space programs effectively. Regional Cooperation could support the country in this effort.

Introduction

Advancements in the space technology have contributed to the human life considerably. The technology has been exploited for making human life easier and more secure in large extent. Space technology application for managing unavoidable natural disasters, human induced disasters and other societal problems/situations is one of such examples. Space technology application has brought the possibilities of real time mapping of disasters and its in-time management. The application of space technology was brought into practice in Nepalese society during 1970's. It has been used for surveying and mapping and land use mapping activities of the country.

Nepal, the Himalayan Kingdom, is a land locked country surrounded by China in the North and India in the rest of the directions. About 17 % of the land is plain and the rest is either hilly or mountainous. About 33% of the land, in the northern belt of the Kingdom, is perennially covered by snow. Only 67% of the land is suitable for human settlement. Due to very difficult geographical structure, the country lacks sufficient transportation networks, as a result of which people do not have easy access to different parts of the country. The diversity in geographical structure results in diversity in social structure and living styles. The social development, in terms of education, per capita, living standard, etc. is heterogeneous in nature. There is a vast gap in the extremities of various aspects of the society. Similarly, the geological structure in the hilly and mountainous country is hazardous. The Nepalese society is equally affected by various types of disasters like flooding,

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landslides, epidemics, etc. Space technology application for managing such disasters including the mapping of societal inequities could contribute in enhancing the respective effectiveness.

State of the Art of Space Technology Application in Nepal

Several Organisations in Nepal are involved in the use and application of space technology. These are: Survey Department, Ministry of Land Reform and Management, Department of Forest, Department of Hydrology and Meteorology, Department of Agriculture, Ministry of Science and Technology, Department of Urban Development and Building Construction, Department of Water Induced Disaster Prevention, Telecommunication Sector, Kathmandu Metropolitan, International Center for Integrated Mountaineering Development (ICIMOD), etc.

Survey Department, the National Mapping Agency of the Kingdom of Nepal, is the leading organisation to launch space programs in Nepal. However, the department is not at the state of launching space programs, as it ought to be. Use of LandSat imagery for the preparation of small scale map/land use map, establishment of Doppler Stations at various places of the country during Geodetic Network establishment, use of global positioning system for the geodetic network extension and updating topographic base map of the country using satellite data imagery are the various activities of the Survey Department in the field of space technology. Recently, Survey Department, with its co-partners, is involved to utilize satellite data for disaster management projects like earthquake disaster management and flood management in the form of mini-projects. These mini-projects are supported by Japanese Aerospace Exploration Agency (JAXA) and being undertaken in collaboration with Asian Institute of Technology, Thailand.

Ministry of Land Reform and Management is currently involved in the creation of land use maps (Land Utilization maps, Land Capability Maps, Land Cover Maps, Soil and Geological Maps, and Meteorological Maps) of whole the country using satellite imagery. Nepal Telecommunication authority is using VSAT technology for data communication by establishing information centers at village level. The other Space technologies are also applied on various activities of urban planning, water shade management, disaster studies and management, forest mapping, agricultural mapping, and geological mapping in Nepal.

Constraints of Space Technology Application in Nepal

Space Technology Application has been brought into practice, in various sectors of government and non-government organization in Nepal since 1970's. His Majesty's Government of Nepal has put the exploitation of the technology for the national interest in its national agenda. However, the application remains inadequate to exploit the full potential of this technology. Some of the constraints in exploiting space technology applications in the full potential are listed as [4, 7] :

- Lack of sufficient allocation of budget and resources for the investment in space technology application sector
- Lack of proper education, research and awareness in the field of space technology
- Lack of proper human resources and the expertise
- Lack of data sharing and co-ordination policies among the organisations involving with space technology application
- Lack of recognized platform to develop the overall space technology to improve access, sharing, integrated and use of space data

Potential Areas for Space Benefits in the Context of Nepalese Society

Information holds a key role for managing the problems of a society. Nepalese society is full of diversity in terms of geographical structure, ecological zone, culture, caste, ethnicity, etc. For proper planning and allocation of resources in justifiable manner, appropriate information of societal situations are required and this could be met by the exploitation of Space Technology with full potential.

It has been already proved that Space Technology applications for natural resource management, scientific management of agricultural land, disaster management and management of other various sectors of society is an effective tool for efficient management. Nepalese society is affected by various kinds of natural disasters. Flood, landslides, out bursting of glacial lakes, earthquakes, epidemics, etc. are the major types of natural disasters that are affecting Nepalese society in great extent. About 75 % of annual downpour of Nepal occurs over a period of three to four month, causing a loss of huge amounts of agricultural land and casualties. There are about 12, 000 landslides each year, 13 % of total area of *churia* and mid-hilly region suffers

from the effect of landslides. At least 44 glacial lakes in the Himalayas are at risk of outburst [5]. Thousands of people in Nepal will loss their lives, due to various types of epidemics, each year. For the study, projection and proper management of such disasters, space application would only be the proper solution.

Most of the Nepalese territory is not easily accessible and ground survey method for mapping is very difficult and time consuming. If one has to study the condition of glacial lakes, land slides and other natural disaster space technology could only be the appropriate means of surveying and mapping. Space technology could be used to acquire such information in time and provides tangible benefits in terms of minimizing losses and reducing vulnerability. Similarly Space technology application could also be used for Geodetic network extension using GPS technology, and Space image data base could also be used for updating land use information and updating of topographic base map of the country.

Efforts of Survey Department for Maximizing Space Benefits for Society

In the changing world of fast growing information technology, the user community is expecting real time geospatial information for their respective use. It is the responsibility of the Survey Department to cope with such expectations. Application of space technology is the best alternative in this regard. Furthermore, the department feels its responsibility to work for maximizing space benefits for the society and hence making its best effort in this line various activities are initiated. Some of the activities are :

a) Human Resource Development: Survey Department has initiated to use the Space imagery digital data on their map updating program. In house training and the abroad training on remote sensing technology with the collaboration of the Asian institute of technology (AIT) Bangkok are conducted for the human resource development purposes. However, more human resources on this technology are required to cope with the demand.

b) Data Sharing Mechanism: Survey Department has recently launched National Geographic Information Infrastructure Programme. The main objective of this programme is to establish a common platform for the geospatial information community for data sharing. Clearinghouse and Metadata facilities would optimize the optimum utilization of data produced by different organisations. Ultimately, the platform will help in maximizing the space application and avoid the duplication of work.

c) Awareness to the users and decision makers: Survey Department has realized that the Nepalese Society is lacking adequate awareness in the field of Space Technology Application. One of the major concerns of the department is to work for enhancing awareness on space application and its benefits. Besides 4th and 23rd Asian Conference on Remote Sensing at Kathmandu held during 1985 and 2002 [3] respectively, Survey Department has taken initiative to conduct various seminars on Space technology at Kathmandu which, of course, enhance the awareness to the users and decision makers. Recently a one-day "Seminar on Space Technology Applications and Recent Developments in Geo-Spatial Products" has been organized in Kathmandu by the department. The seminar was organized on August 17, 2005. About 200 professionals from different organizations such as governmental, non-governmental, international non-governmental, private sector, researchers etc. participated the seminar. The main objective of the seminar was to spread awareness on space technology to decision makers so that the interest of top level decision makers could be drawn towards the investment of government in this sector. The other achievement of the seminar was that various organizations got the platform to share their views, status and ideas related to space technology applications.

Nepal Remote Sensing and Photogrammetry Society conducted a one-day workshop on April 11, 2005 to celebrate its 14th Anniversary day. The members shared their knowledge on application of Remote Sensing for various purposes. The seminar was supported by Survey Department.

d) Affiliation with International Organisations: Survey Department is a member of various international organisations related with geoinformation science. International organizations related to space applications like Asia Pacific Regional Space Agency Forum (APRSAF), Japanese Aerospace Exploration Agency (JAXA), Asian Institute of Technology (AIT), Asian Association on Remote Sensing (AARS), Group on

Earth Observations (GEO), International Federation of Surveyor (FIG), International Society for Photogrammetry and Remote Sensing (ISPRS) and International Steering Committee for Global Mapping (ISCGM) are the organisations to which the department is affiliated with one way or another. The department is keeping in touch with these organisations for the promotion of space technology application in Nepal either by participating their events or by presenting its state of art of the technology.

e) Projects and research activities supported by JAXA: Survey Department was also involved on the Mini-project entitled "Study of change in land use of Kathmandu valley" with the collaboration of Japanese Aerospace Exploration Agency (JAXA) and Asian Institute of Technology (AIT), Thailand in 2004. The objective of the mini-project was to implement space development for promoting space technology. Survey department was working with Department of Urban Development and Building Construction (DUDBC), Nepal for this project. The second part of the Mini-project is shortly going to be started. This part will work for the mitigation of earthquake disaster in Kathmandu valley. DUDBC will be the supporting partner. Similarly, one more mini-project based on management of disaster caused by flood in Terai region has been accepted by JAXA for this year. The project will also be conducted with collaboration of AIT and Department of Water Induced Disaster Prevention (DWIDP), Nepal as supporting partner. The training programmes for both the mini-projects are being started at AIT from October 10, 2005. Four officials from Survey Department, one from DUDBC and one from DWIDP are participating the training.

Regional Co-operation

As the space technology is highly expensive, developing countries like Nepal cannot afford the expenses of launching space programs on their own. Regional co-operation is required for establishment of basic infrastructures including procurement of images and related software and production of the human resources in sufficient number to work with the technology Major sectors for which regional cooperation is expected can be listed as:

a) Human Resource Development: There are no any academic institutions related to space technology in Nepal. Opportunities for academic courses, advanced training, and other means of human resource development are considered as one of the most important areas for which regional cooperation is required. Furthermore, opportunities for participating at regional forums like seminars, workshops would also contribute in human resource development of the country in this sector.

b) Resource/Data Sharing: The opportunities for sharing regional resources to optimize the space application would contribute in a significant scale in this regard. Hence, such a platform should be created through the establishment of Regional Spatial Data Infrastructure (RSDI). Survey Department would act as a nodal point for resources and data sharing, so that other organization could share their information.

c) Disaster monitoring: Space technology can effectively provide information for disaster management. Space agencies and the end users should co-operate and share data for rapid response and application. Regional co-operation is expected on capacity building for data interpretation and the use.

d) Ground Station: Advanced Land Observing Satellite (ALOS), The International Space Station and Japanese Experimental Module (JEM) are currently under construction and will become operational in future. Ground base collaborative activities could be done by establishing satellite ground station at Kathmandu, Nepal, which will cover the region Autonomous region-Tibet (China), Nepal, India, Bangladesh, and Pakistan for efficient and effective utilization of JEM. Regional co-operation is expected on the establishment of satellite ground station at Nagarkot (near Kathmandu valley). Nagarkot Observatory of Survey Department is an ideal place for satellite ground station in this region.

Conclusion

Nepalese society has a number of potential areas where the space benefits could be maximized. Various natural as well as human induced disasters, from which Nepalese society is directly or indirectly affected, could be managed effectively by the exploitation of space technology.

It is the need of time to work for maximizing space benefits. Despite numerous constraints, Survey Department is making its best effort in this regard. Initiation of collaborative approach for space technology application for the management of different types of natural disasters is one of such efforts. The support of JAXA for capacity building of Survey Department by conducting mini-projects for disaster management has motivated the department to work in this area with greater effort. Coordination among the organisations involving in space technology application and enhancing awareness in its importance could boost up the effectiveness. Furthermore, regional cooperation in this sector including human resource development, a proper platform for data sharing, etc. is equally essential for maximizing space benefits for Nepalese society.

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Private Discussions with Nepalese Professionals of Space Technology.