

Pakistan's Space Programme

Introduction

The launching of first artificial satellite Sputnik-1 in 1957 and Apollo-11's landing on the Moon in 1969 were spectacular achievements that satisfied the human quest to reach out into the vast outer space. But in the fifty years since the beginning of the space age, the opportunities offered by space, space-based assets and their applications have brought about a quiet revolution and a profound change in the world in which we live. Today, some 900 satellites are in orbit, operated by more than 40 countries. Almost 7000 satellites have been launched since 1957.

Space-based assets have now become indispensable to modern life whether it is live telecast of events across the world or beyond, the ubiquitous Internet, the telecommunications revolution, satellite weather forecasting, mapping, mineral exploration, water resource management, disaster mitigation, national security or hundreds of other applications, life without these would now be quite difficult, to say the least.

Pakistan's Need for Space Capability

Pakistan is a large and populous country. It also entertains great diversity in culture, ethnicity, terrain and climate. Like other developing countries, it faces a number of socioeconomic problems such as poverty, hunger, over-population, illiteracy, healthcare, and energy and water shortage. In Baluchistan, Northern areas, mountainous region of NWFP and deserts of Sindh, some additional problems include poor telecommunication, rail and road infrastructure and rugged and inaccessible terrain. Finding solutions for all these problems through conventional methods is difficult, if not impossible.

Space exploration is amongst the most fascinating ventures of modern times. It contributes to investigation of physical conditions in space, on stars, planets, and other celestial bodies through the use of artificial satellites and space probes carried onboard spacecrafts beyond the Earth's atmosphere. The competence and capabilities in relevant areas of space science and technology for space exploration could help attain sustainable socio-economic development and improve the quality of life of the people of Pakistan.

Space-based communication systems offer fast and affordable means of providing services like tele-education, telemedicine, mobile telephony and television to remote areas. The diversity and cultural exchanges of our populations can be better

served by television broadcasting via satellites. Similarly, communication satellites provide an important and essential communication medium to armed forces.

Remote sensing satellites have great potential in contributing to better land management, food security, disaster management, urban planning, mineral exploration, crop yield forecasting, water management, etc.

Weather has a profound effect on life. Weather satellites provide forecasts on temperature, precipitation, cloudiness and winds have both civilian and military applications. For a water-stressed country like Pakistan, the economy of which is largely agrarian, climate and weather and their effect on availability of water are crucial factors. Weather forecasts and warnings are also important because they protect life and property. Forecasts about temperature and precipitation are needed for agricultural applications.

Several Global Navigation Satellite Systems (GNSS) are either in operation or under development. These provide free and reliable positioning, navigation, and timing services on a continuous worldwide basis. Some of the applications include land surveying, map-making, tracking and surveillance scientific study of earthquakes, disaster relief and emergency services in life-saving missions. Farmers, surveyors, geologists and many others perform their work more efficiently, safely, economically, and accurately using GPS signals.

Pakistan's Space Programme – Historical Background

Pakistan's leading scientists, convinced of the importance of space for the future prosperity of the country, persuaded the government to set up an organization to deal with space. Consequently, Space Sciences and Research Wing of Pakistan Atomic Energy Commission (PAEC) was established in 1961. It was renamed as Pakistan Space & Upper Atmosphere Research Committee (SUPARCO) and placed under the able guidance and leadership of Prof Abdus Salam as Chairman and Dr I H Usmani as Vice Chairman. SUPARCO was granted the status of Commission in 1981 and declared as the national space agency responsible for the implementation and execution of space programmes. A Space Research Council (SRC) was established to oversee and formulate policies for Pakistan's Space Programme. In 1984, the government of Pakistan approved the long-term Space Science and Technology Development Programme which comprised four components.

Component A: Establishment of ground stations and ancillary facilities for reception and use of scientific data including imagery of the earth for natural resources survey, and reception and study of Very Low and High Frequency communications signals.

Component B: Establishment of satellite tracking facilities such as optical radar and laser tracking stations.

Component C: Launching of multi-purpose satellites for point-to-point telecommunications, TV broadcasting and scientific observations.

Component D: Development of satellites and complete satellite launch vehicles.

SUPARCO's Mission Statement

"Strive to achieve self-reliance in space technology and applications for national security, economy and society."

SUPARCO's Facilities

SUPARCO has several establishments spread all over the country. The main ones at Karachi include: SUPARCO HQs; Plant; Satellite Research & Development Center; Satellite Ground Control Station; National Center for Remote Sensing and Geoinformatics; Remote Sensing and GIS Labs; Pakistan Mission Control Center (PMCC) and Local User Terminal (LUT) for COSPAS-SARSAT International search & rescue programme; Ionospheric Research Station (IRS); Geomagnetic Observatory; Space & Atmospheric Research Station and a Geomagnetic Observatory.

SUPARCO's Achievements and Capabilities

SUPARCO launched its first sounding rocket Rehbar-1 for upper atmosphere research in 1961 becoming the third nation in Asia and the tenth in the world to launch such a rocket. It later developed sounding rockets indigenously. SUPARCO also developed two experimental satellites Badr-1 and Badr-B which were launched in 1990 and 2001 respectively. Later, work was undertaken on development of prototype communication and remote-sensing satellites. The knowledge gained and the skills developed through these projects played an important role in SUPARCO's contribution to the development of Paksat-1R communication satellite in collaboration with China. The satellite was successfully launched on 12 Aug 2011 from Xichang Satellite Launch Centre in China. SUPARCO now aims to develop a remote sensing satellite as part of its vision 2040, which has recently been approved by Government of Pakistan.

Unless the country has sufficient demand for data and services from space-based assets, any investment in satellites is futile. SUPARCO had therefore started to develop its capability and capacity in space applications in the early 1970s. A satellite ground station was established at Rawat, near Islamabad in 1989, and satellite remote sensing (SRS) data started to be downloaded, archived and

processed at the station. Later, the station was upgraded to receive data from the French SPOT series of satellites.

Concurrently, research and development work on SRS applications to meet Pakistan's specific needs was undertaken. Several projects in the areas of agriculture, water resource management, mapping, surveying, environmental monitoring, disaster management and mitigation etc, were undertaken. Some of the major projects are listed below:

- Crop monitoring and yield forecasting.
- Development of Geographic Information System for water courses monitoring under the National Program for the Improvement of Watercourses.
- Survey of Karachi Circular Railways to update map and identify encroachments.
- Environmental assessment of power projects.
- Strategic Country Environmental Impact Assessment.
- Environmental Monitoring at DHA Karachi Waterfront Development Project.
- Disaster monitoring and mitigation support during the earthquake of 2005, and the floods of 2007 and 2010.
- Assessment of breaches in the Left Bank Outfall Drain (LBOD), and their environmental impact.
- Flood inundation profiling.
- Landuse mapping of Pakistan and AJK.
- Support to National Highway Authority for surveying.
- Monitoring of Mangrove forests along the coast of Pakistan.
- Mapping and GIS of the kacho area of river Indus in the province of Sindh.
- Vehicle tracking and fleet management solutions.

In order to promote the use of space technology in all pertinent walks of life in the country, there is a need to create awareness amongst the decision-makers, of the benefits and uses of space technology for the socio-economic development of the country. It is also necessary that capability and capacity be developed in the user agencies/departments for them to be able to effectively apply space applications technologies. SUPARCO employs a variety of means to promote space technology

and create awareness of its benefits. These include seminars, symposia, workshops and courses. The National Centre of Remote Sensing and Geo-informatics, established in Karachi in 2007, offers a variety of short and long courses. Since 2009, the centre has started Master's program in Geo-informatics as a constituent of the Institute of Space Technology.

Given the country's meager financial resources, on the eve of our 50th anniversary, we at SUPARCO, look back at our achievements with satisfaction and look forward to a bright future, particularly if we continue to receive the government and the public's moral and financial support. We have no doubt that we should be able to achieve all the targets of Pakistan's Space Vision 2040.