Strategic development of pakistan and indian space programme

Development of Pakistan Space Programme:

Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) is Pakistan's national space agency and were established in 1961 as a committee and were granted the status of a Commission in 1981. [1]SUPARCO is devoted to Research and Development work in Space Sciences and Space Technology and their applications for the peaceful uses of outer space. It works towards developing indigenous capabilities in space technology and to promote space applications for socio-economic uplift of the country.

Peaceful Aspects of Pakistan Space Programme:

Communication Satellite:

Badar-1

Badr-1 (Badr-A) was Pakistan's first indigenously developed satellite and was launched from the Xichang Launch Center, China on July 16, 1990 aboard a Chinese Long March 2E rocket. Badr-1 weighed 150 pounds. Originally designed for a circular orbit at 250-300 miles altitude, Badr-1 actually was inserted by the Long March rocket into an elliptical orbit of 127-615 miles. The satellite successfully completed its designed life.[2]

SUPARCO started building the small amateur radio satellite in late 1986 with support from the Pakistan Amateur Radio Society. The satellite was named Badr inspired from the Urdu language word for ' new moon'. Badr-1 was planned to be launched on the US Space Shuttle, but the 1986 Challenger explosion and consequent delay in American flights changed the plan.

PakSat-1:

Pakistan’s first geostationary satellite was Paksat 1. its main objective was to serve Indonesia and earlier it was called Palapa.[3]It was named Anatolia 1due to some electronic failure and then renamed again to Paksat 1 in 2002. Boeing originally manufactured it and used the HS 601 spacecraft design. It was launched on February 1, 1996.

Paksat-1R Satellite:

Paksat-1R satellite is a replacing satellite of Paksat-1. It will be sent in space in 2010. The advice about the manufacture, launch and purchase of Paksat-1R is received under the deal with Telesat. Deal was signed in March 2007 by Pakistan’s national space agency.[4]The manufacture of new satellites and launch of the satellites will also be helped by Telesat.

Earth Observational Satellite:

Badr-B

Pakistan’s second satellite which was an Earth Observation Satellite known as BADR-B. Was launched on 10 December 2001 on a Zenit 2 rocket from Baikonur Cosmodrome, Kazakhstan. The designing was done by Space Innovations Limited from the UK.[5]

Pakistan Remote Sensing Satellite System (PRSSS)

BADR series was successfully launched and operated. The series was a Low Earth Observational satellite (BADR-1 and BADR-B). Launched in the 1990s and early 2000s. to meet the national and international needs in satellite imagery SUPARCO now plans to launch high resolution Pakistan Remote Sensing Satellite (PRSSS).[6]

A study was concluded on feasibility and system definition in January 2007 which recommended the launch of a constellation of Optical and Synthetic Aperture Radar (SAR). Launch of RFP for the manufacturing of the satellite is planned in the third quarter of year 2008.[7]

SUPARCO plans PRSS to be progressive and sustainable program and plans to launch by the end of year 2011 an optical satellite with payload of 2. 5 meter PAN in 700 km sun-synchronous orbit, which will be followed by a series of optical and SAR satellites in future. A necessary infrastructure is needed for ground control and image reception and processing is also planned to be setup.[8]SUPARCO is still struggling to develop his satellite but its not clear yet the launching will be done from Pakistan’s Satellite launchers or Chinese Satellite Launchers.

Military Aspects of Pakistan Space Programme:

Pakistan is developing its missiles program since 1980s. These missiles are totally military. Pakistan’s military proudly contains short, medium and intermediate range ballistic missiles. Ghauri a medium range missile was tested on April 6, 1998. Ghauri Missile can carry a payload of 700 kg to an optimum range of 1500 kilometres. Pakistan’s ballistic missiles is a crystal clear example of the expertise in this field and it the indigenous program of Pakistan.[9]

United States intelligence have reportedly talked about the ties between SUPARCO and Kahuta Research Laboratories (the key producer of Pakistan’s ballistic missiles) and also reports that some kind of agreement has taken palace between north Korea, Pakistan and Iran back in 1993.[10]Advance

ballistic missile technology will be used by the Pakistan’s Satellite Launch Vehicles Kahuta Research Laboratories (with possible involvement with SUPARCO and/or North Korea). Indian SLV-3/ASLV used Agni ballistic missile as the first stage and as boosters. As with India, China, and North Korea; Pakistan might use Ghauri/Saheen/Abdali/Ghaznavi type ballistic missiles as its stages (possibly first and second)

Pakistani Satellite Launch Vehicle’s first model have three stages and it is estimated that it can place a payload weighing less than 80 kilogram to an orbit 450 kilometres above Earth’s surface. However the exact data remains unknown. The second model of the SLV contains four extra boosters but have the design as that of the first. SLV boosters are developed from the missile technology of the nation. Therefore it is fair to assume that the boosters on the second model might also be based on one of Pakistan’s ballistic missiles.[11]

Pakistan also owns to high altitude sounding rockets Shahpar and Rakhnum. Former is a 7 meter solid fuel two stage rocket that can carry a payload of 55 kilograms to an altitude of 450 kilometres whereas latter can lift a payload of 38 kilograms to an altitude of 100 kilometres. These achievements according to United States sources points to the agreement which is earlier mentioned [10]. This can be taken true as both Pakistan and Iran plans to launch satellite of their own. North Korea’s ballistic missile technology is also suspected to help these to countries. The evidence can be of the presence of the Pakistani and Iranian personals on the launching day of Taep’o-dong 1 North Korean SLV.[12]

Both Iran and Pakistan are racing towards space. On January 2004 Iranian authorities reported that their indigenous SLV will soon place a satellite in orbit. While Pakistan, on the other hand, plans to launch an SLV within the next five years. The exact nature of Pakistan’s SLV program remains unknown. However, judging from Pakistan’s ballistic missile technology, it can be said that Pakistan Government and Suparco might just be waiting for the right moment to test Pakistan’s first satellite launch vehicle.

Development of Indian Space Programme:

Government of India controls the main body of space research The Indian Space Research Organisation and one of the leading space research organizations in the world. It was established in its modern form in 1969. according to the highest budget associated to it is considered more efficient as compared to the organizations of the other countries.

Under the guidance of a number of scientists, ISRO has conducted a variety of operations for both Indian and foreign clients. ISRO’s satellite launch capability is provided by indigenous launch vehicles and launch sites. In 2008, ISRO successfully launched its first lunar probe, Chandrayaan-1, while future plans include manned space missions, further lunar exploration, and interplanetary probes. ISRO has several field installations as assets, and cooperates with the international community as a part of several bilateral and multilateral agreements.

Projected Space Development Programs:

The Indians have embarked on a number to satellite development projects to be completed by the end of the decade. Among these is proto-INSAT, which

will be used in establishing design parameters for indigenously built INSAT replacement satellites. However, it is in the area of booster technology that impressive advances can be anticipated in the near term. During the 1980s, India intends to produce an augmented satellite launch vehicle (ASLV) and a polar satellite launch vehicle (PSLV). The ASLV will consist of an SLV-3 with two first-stage SLV-3 rockets as strap-on boosters. The ASLV will be able to inject a 150 kg payload into low-earth orbit, as compared with the 35-50 kg lift capacity of the SLV-3. As presently configured, the PSLV will consist of a solid fuel booster with six strap-on motors derived from the SLV-3 first stage, a liquid fuel second stage, and two solid fuel upper stages. This launch vehicle, designed to place a 1000 kg payload into a 900 km polar synchronous orbit, is expected to be operational by 1987.

Dr. Abdul Kalam, head of launch vehicle development in the ISRO, has declared that by 1990 India will be able to position a 2500 kg communication satellite into geosynchronous orbit at 36, 000 km. He has further asserted that the ISRO can produce a cryogenic rocket engine (using liquid oxygen and liquid hydrogen) during the l980s. The Indians consider cryogenic engines more cost effective than rockets employing solid or storable liquid fuel because of greater thrust generation and the possibility of reduced vehicle size.[13]

Military Implications of Space Research:

The advances in the rocket and satellite technology is not the important aspect of the military capability and it is described by the Indian leadership. Thus, for example, the Minister of State in the Ministry of Defense appraised Parliament after the launching of Rohini I that no plans existed for the

manufacture of IRBMs.[14]Despite such pronouncements potential military applications of Indian space technology are manifold, to include development of reconnaissance satellites, improvements in command and control, greater precision in operational planning based on satellite-derived meteorological data, and IRBM production.

Reconnaissance satellites:

India has already designed a satellite camera system and placed it into orbit. While the resolution of the Rohini II landmark sensor was inadequate for detailed surveillance activity, it would have allowed New Delhi to locate road and rail nets in neighbouring countries. The 1981 acquisition of advanced MiG-25 Foxbat reconnaissance aircraft from the Soviet Union evidences India’s interest in improving its ability to monitor military installations and troop movements in Pakistan and China. The production of satellites (employing sophisticated optics either indigenously fabricated or acquired from third countries) would appreciably augment India’s existing photographic intelligence resources.

Command and control:

A substantial upgrading of India’s domestic communication infrastructure constitutes a fundamental objective of the INSAT program. The INSAT-IB platform will have twelve communication channels, each able to handle 2000 telephone conversations, plus two direct broadcast television channels. The applicability of such an information transmission system to defence requirements is patent. Thus, for example, the six mobile down links associated with INSAT may well prove forerunners of systems integrated into army units that will enable these units to deploy from peacetime

cantonments with little or no communication disruption. Similarly, satellites could increase the effectiveness of the Indian Navy both by ensuring continuous communication with all naval vessels and improving the accuracy of maritime navigation. In this context, it must be appreciated that India's armed forces comprise the world's fourth largest army, the fifth largest air force, and a navy transitioning from a coastal defence force to a blue-water fleet. A military organization of this magnitude, with installations distributed throughout India and numerous warships at sea, would derive particular benefit from a satellite-enhanced C3 network.

Weather forecasting:

Weather conditions form a critical variable in military planning. The greater precision in weather forecasting afforded by Indian meteorological satellites will, in consequence, materially assist planners in structuring military exercises or actual combat operations.

Intermediate-range ballistic missiles:

The Indian political leadership has consistently asserted that the activities of the Department of Space are non-military in nature. However, Satish Dhawan declared in 1979 that the SLV-3 could be converted into an IRBM with a range of approximately 1500 km.[15]Adoption of such a course of action would appear to have the support of India's armed forces. An editorial in the November 1981 edition of Vikrant, a semi-official Indian military publication, states that India". . . must possess adequate capability for strategic long-range strike in the form of MRBM/ IRBMs equipped with nuclear warheads, a strategic air strike and interdictor force and adequate air defence, all equally complementary and coordinated."[16]

SLV-3 into a nuclear carrier is not just the question of payload but a technology of high modifications is needed. First, a re-entry heat shield capable of withstanding temperatures of several thousand degrees centigrade must be developed. It has been reported that Indian scientists are presently endeavouring to perfect an ablative heat shield system that would satisfy this requirement.[17]Second, sophisticated guidance systems are needed to ensure that warheads arrive at their targets. India's demonstrated capability to manoeuvre a satellite into geosynchronous orbit evidences possession of sensitive position-correcting instruments. According to the senior scientist of India it is proposed that the guidance system can be used in the defence after some modifications.[18]

Part II

Comparative Study of Pakistan and India Space Programme

Nature of India's Missile Programme:

Indians have a high vision about the India military necessity for the ballistic missile program. The initial push , indeed, was to come from India initiatives in space exploration, which was part of the larger Nehruvian vision of building scientific temper in Indian society, in 1980, as a follow up of Indira Gandhi's attempts to build islands of excellence in certain sectors, India become the first developing country and 6th in the world after Russia, USA, France, Japan, And China to put a satellite, Rohini 1 into orbit, using its own launch vehicle. India has moved a way on the road which leads to ballistic missiles and still they describes it as technology demonstrators. Pakistan on the other hand has shown no such inhibitions about its missiles.

Underlying India’s Expensive ambitions for building ballistic missiles, the launching of Integrated Guided Missile Development Programme (IGMDP) was followed by India by setting up an extensive R&D network of 45 research facilities, of which as many as 19 are engaged with various aspects of missile design. Several missile tests down the line, India today, has a whole range of missiles and has since moved to rarefying its missile projections. India’s nuclear posture has surely provided another kick start as also added to both the legitimacy as also necessity of missile.

Missiles

Range (Km)

Payload

CEP

Estimated Nos

Prithvi I

40-150

800

50m

130

Prithvi II

40-250

500-750

75m

70

Prithivi III

40-350

500-750

Unknown

Unknown

Dhanush

40-250

500-750

75m

70

Agni I

2, 500

1, 000

100m

5-9

Agni II

3000-3, 500

1, 000

100m

1-2

Agni III

5, 000

Unknown

Unknown

2Source: Andrew Feickert and K. Alan Kronstadp, Missile Proliferation and the Strategic Balance in South Asia, CRS report for Congress, Congressional research Service, the library of Congress, Washington DC: 17th October 2003.

Nature of Pakistani Space Programme:

At the very outset, Indian and Pakistani missile programmes had their origins in their respective space explorations programmes, but while india’s Space programme was to emerge as robust and global in several sectors, Pakistani Space programme remained weaker and gradually, it made constant and impressive progress in building ballistic missiles. Briefly, the initial Pakistani effort had started with the setting up of its space and upper atmosphere

research community in Sep 1961. India had followed the lead by setting up space research from early 1962, though the Indian space research organization was to be set up only in 1969. but follow up events were soon to change these equations in Pakistan’s favour.

Secondly, what was to become a distinct component of Pakistan’s missile programme was its strong links with external players-first the US and France but then far more extensive and enduring link with China and more recently with North Korea. India’s over all military profile and its nuclear and missile programme had provided strong motivations for Pakistan.[19]Nevertheless while India had launched its IGMDP, in 1983, it was not till 25th April 1988 then Pakistan made any claims about ballistic missiles tests and this claim was later corroborated by the February 5th, 1989. The story since then has been one of success.

Missiles

Range(km)

Payload(Kg)

CEP

Estimated No’s

Hataf I

60-100

100-500

Unknown

80

Hataf II

280-450

300-500

200m

Unknown

M-11

300

500

600m

30-84

Shaheen I

600

750

200m

5-10

Shaheen II

2500

750

350m

5-10

Ghauri I

1500

760

2500m

5-10

Ghauri II

1800-2300

760

unknown

unknown

Source : Andrew Feickert and K. Alan Kronstadp, Missile Proliferation and the Strategic Balance in South Asia, CRS report for Congress, Congressional research Service, the library of Congress, Washington DC: 17th October 2003.

Part III

Effect of India's Space Programme on Pakistan

Indian Ballistic Missile Defense Program:

India protects its country from missile attacks by a multi layered ballistic missile defence which can be developed and deployed. It is an indigenous program of the Indian missile defence program.[20]

The program of India's ballistic missile was initiated in the response to the ballistic missile program of Pakistan.[21]. It is a two tiered system consisting of two interceptor missiles, namely the Prithvi Air Defence (PAD) missile for high altitude interception, and the Advanced Air Defence (AAD) Missile for lower altitude interception. The two-tiered shield should be able to intercept any incoming missile launched 5, 000 kilometres away

Prithvi Air Defence (PAD) / Pradyumna Ballistic Missile Interceptor

Prithvi Air Defence (PAD) is an anti-ballistic missile which can intercept any ballistic missile which comes in the atmosphere. Based on the Prithvi missile, It is a two stage missile, the first stage is a liquid fuelled motor that uses two propellants and oxidizers while second stage is solid fuelled.[22]It has divert thrusters which can generate a lateral acceleration at more than 5 Gs at 50 km altitude. Guidance is provided by inertial navigation system, mid-course updates from long range tracking radar (LRTR) and active radar homing in the terminal phase. PAD has capability to engage 300 to 2, 000 km class of ballistic missiles at a speed of Mach 5.[23]

Long Range Tracking Radar is the target acquisition and fire control Radar for PAD Missile. It is an active phased array radar having capability to track 200 targets at a range of 600 km.[24]The Prithvi Air Defense missile has been named as Pradyumna.[25]

Further development led to the improvement of the interception range to 80 km from the 50 km range. The improved missile will utilize a gimbaled directional warhead, a technology that until now has only been used by the US and Russia. Smaller warheads can be destroyed with this technology.

Pakistan's Missile Targeting Strategy to Counter India's Missiles:

HATF Series – HATF series formed the initial component of the Pakistani missile arsenal. It was also planned as a counter to India's Prithvi missile. Besides the nuclear capability of HATF II and III, in the conventional mode it was designed as an offensive weapon to knock off Indian armour concentrations. If its used defensively then it can be used with two purposes to destroy Indian army entering into the Pakistani territory. Its main purpose is at the borders of Pakistan joining with India near and far.[26]

GHAURI Series – With its extended range, the GHAURI series could effectively reach virtually the whole of India but it seems that the strategic targeting of this missile would be more towards Mumbai and Peninsular India in which lie India's most sensitive installations. GHAURI is a mobile system and could be used for counter-value-strikes. Pakistan claims that GHAURI can carry nuclear, chemical and anti-tank warheads.

SHAHEEN Series – SHAHEEN II unveiled on Pakistan Day Parade (March 23, 2000) is Pakistan's answer to India's Agni II. It has as an all India coverage, but can be said to have Mumbai and Peninsular India as the main target. With its ground mobility and solid state propellant systems it should logically form the backbone of Pakistani nuclear deterrent. With mobility comes survivability and therefore the SHAHEEN II could impart to Pakistan a second strike capability in the future.

The above is a broad analysis of Pakistani's missile targeting strategy. Detailed analysis is outside the scope of this paper. Suffice it to say, that other than large scale population centres of Uttar Pradesh and Bihar in North India heartland there are no lucrative or counter- value targets for Pakistan. In the past analysts have carried out checks on the Indian Muslim population concentrations in North India and came to the conclusion that because of high proportion of Indian Muslim population in these urban centres, Pakistan would be unlikely to target them. However in a recent interview on BBC, General Pervez Musharraf, the military ruler of Pakistan, when questioned on this aspect, first hesitated to answer and when pressed by the British interviewer stated to the effect that nothing is precluded, if Pakistan's supreme national interests are in jeopardy i. e. Indian Muslims are dispensable.

Pakistan's missile build-up all along has been India-centric. Unlike India, which has to take the China threat into consideration, Pakistan has the luxury to focus its entire missile build-up on Indian developments.

Strategically, Pakistan has today not only offset India’s overwhelming conventional military superiority by its nuclear weaponisation but also acquired a missile force which in terms of speed of acquisition outstrips India’s pace of development of missiles. China prominently and DPRK by proxy have significantly contributed to Pakistan’s missile build-up. China has even provided a complete plant in 1995 to produce M-11 nuclear capable M-11 missiles and their variants in Pakistan. China has persistently defied international non-proliferation norms and US pressures against Chinese proliferation of WMD’s in Pakistan. No indicators are available to suggest that China would desist in future too. China’s South Asian policy objective to strategically de-stabilise India would continue unabated, despite protestations to the contrary.

India has no political or military options to limit Pakistan’s nuclear weaponisation and missile build-up. Pakistan can only be limited by India imposing an economically unaffordable counter-buildup in these fields-uneconomical for Pakistan and her benefactors too. Needless to say that this is an imperative if peace and stability have to prevail in South Asia.

Part IV

Impact of Indian and Pakistan Space Programme on International Environment

China:

After China’s Shenzhou-VII successful space walk during Sep 2008 China became the third country after the United States (US) and Russia to walk into space independently. This was China’s third manned ‘ space-ship’.

Simultaneously, India also joined the elite club of moon missions with the launch of Chandrayaan-1. With this India has become the third country in Asia to achieve this feat.

Chnia’s and india’s space program have increased the doubts among many countries that they are in a space race. In fact, it prompts many to review in a comparative manner the current trends in China and India’s ‘ Space-policy’. This article explains the China and India’s space program with their different perspective, policy, technology and transparency..[27]

On a comparative scale, both China and India have a definite and constructive Space plan. India’s civilian Space programme makes it today, a credible space power internationally. At the same time, through Shenzhou-VII Space walk mission, China has effectively challenged the supremacy of both the United States and Russia in this ‘ sector’ of Space.[28]However, both India and China lag much behind these ‘ Space superpowers’ in various other Space fields. Both, at the same time have demonstrated that in Asia barring Japan, they have no other competitors in this field. Both the sates, with their intelligent investments in ‘ Space field’ and a clear-cut roadmap ahead of them, have demonstrated to the world, their techno-economical strengths. Few call it, ‘ Asian Space race’ but in reality, this is what a ‘ soft-power status’ is all about.

China, Pakistan cooperation in space:

Pakistan-China bilateral cooperation in the space industry could span a broad spectrum, including climate science, clean energy technologies, clean water

technologies, cyber-security, basic space, atmospheric and earth sciences, and marine sciences.

It is worth mentioning that it was China that launched Pakistan’s first satellite into orbit in 1990 because Pakistan had no spaceport. Badr-A, Pakistan’s first indigenously developed satellite, was launched on July 16 that year from Xichang Launch Center in south-western China’s Sichuan province. It was launched with the Long March 2E rocket, which is designed to lift 6, 800 kilograms to a low elliptical orbit ranging from 400 to 800 kilometers above Earth. The rocket, called Cluster Carrier, blasted off from a new pad built to launch bigger boosters. The Long March 2E, with four boosters strapped on, carried a large Australian dummy satellite. The satellite successfully completed its life.[29]

Experts in Pakistan view China as the only country that is in a position to transfer space technology to Pakistan. In the initial stages, Pakistan would place its satellite in orbit with Chinese assistance and later develop rockets indigenously.

Launching a remote-sensing satellite is Pakistan’s first priority because such a satellite can be used in a variety of cartographic studies. Chinese rocket technology, according to the experts, is the best in the world – the United States drops satellites into the sea and then a special ship recovers them, while China has succeeded in landing its spacecraft on ground.

Russia:

Space is another key sector of cooperation between India and Russia. During President Vladimir Putin’s visit to India in December 2004, two space-related

bilateral agreements were signed viz. Inter-Governmental umbrella Agreement on cooperation in the outer space for peaceful purposes and the Inter Space Agency Agreement on cooperation in the Russian satellite navigation system “ GLONASS”. Subsequently a number of follow-up agreements on GLONASS have been signed. In November 2007, the two countries have signed an agreement on joint lunar exploration. These space cooperation programmes are under implementation.[30]

India and Russia signed a memorandum of understandi