

Department of Space

Statement of Outlays and Outcomes/Targets: Annual Plan 2005-06

(Rs. in crores)

Sl. No	Name of the Scheme	Intended Objective / Outcome	Outlay 2005-06	Quantifiable deliverables (On quarterly basis)	Processes / Timelines	Remarks / Risk factor
1	2	3	4	5	6	7
<b>1</b>	<b>MAJOR PROJECTS (already sanctioned)</b>					
1.1	GSLV	Develop a launch vehicle to launch 2T class INSAT satellite into GTO through three developmental flights viz., GSLV D1, D2 and D3 flights.	17.95	<ul style="list-style-type: none"> <li>o Delivery of S 139 solid stage hardware for GSLV D3. (III quarter)</li> <li>o Delivery of L-40 structure for GSLV D3 (III quarter)</li> </ul>	Approved / Ongoing project	GSLV D1 and D2 have been successfully launched during 2001 and 2003. GSLV D3 is planned for launch in 2006-07.
1.2	GSLV Operational	To fabricate and launch 3 operational GSLV launch vehicles (GSLV F1,F2 & F3) and take advance procurement actions for additional 3 vehicles.	181.17	<ul style="list-style-type: none"> <li>o Readiness of L-40 strapons, solid motors and Cryo (imported) stages for GSLV F02. (III Quarter)</li> <li>o Initiation of launch campaign activities for GSLV F02. (IV quarter)</li> </ul>	GSLV F01 to F03 already approved. Proposal for further flights F04 to F10 under process for approval. Cabinet approval expected by September 2005.	<ul style="list-style-type: none"> <li>o GSLV F1 successfully launched EDUSAT in 2004.</li> <li>o Draft cabinet note for GSLV F4-F10 (Rs. 1588 crores) cleared by Planning Commission.</li> </ul>

Department of Space

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1.3	Cryogenic Upper Stage Project (CUSP)	Develop and qualify a restartable cryogenic engine and stage for GSLV	1.67	<ul style="list-style-type: none"> <li>o Completion of Indigenous Cryostage hot tests on proto stage (III quarter)</li> <li>o Hardware realisation of flight stage (IV quarter).</li> </ul>	Approved / Ongoing project	Indigenous cryo engine has been successfully tested for cumulative test duration of more than 7000 seconds.
1.4	GSLV Mk III	To develop a Geosynchronous satellite launch vehicle capable of launching 4T INSAT satellites to GTO.	450.00	<ul style="list-style-type: none"> <li>o Readiness of Proof pressure test facility, turbo pump test facility and hardware-in- loop simulation and flex seal test facility. (II quarter)</li> <li>o Readiness of LH2 plant, solid propellant plant, vertical assembly building, Solid stage assembly building, C25/L110 assembly and integration building (IV Quarter)</li> <li>o L110 engine qualification for long duration tests (III quarter).</li> <li>o Realisation of First S 200 solid motor case segment, L110 &amp; C25 propellant tanks development, first set of four structures, first set of avionics packages for system evaluation, turbo pump and gas generator. (IV quarter)</li> </ul>	Approved / Ongoing project	The first development flight of GSLV Mk III is targeted for 2007-08.

Department of Space

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1.5	PSLV-C	To fabricate and launch seven PSLV operational launch vehicles (PSLV C7 - C13) and take advance action for procurement of materials for two more flights PSLV C14 and C15.	120.00	<ul style="list-style-type: none"> <li>o Launch of PSLV C7 carrying Cartosat-2 / SRE (III quarter)</li> <li>o Launch of PSLV C8 carrying AGILE satellite and advanced avionics module for launch vehicles (IV quarter).</li> </ul>	Approved / Ongoing project	PSLV C6 launched Cartosat-1 and HAMSAT successfully on May 5, 2005.
1.6	Second Launch Pad (SLP)	Construction and establishment of a Second Launch Pad at Sriharikota to support the operational launch services.	5.00	Commissioning of Cryo processing facilities required for GSLV launch (III quarter).	Approved / Ongoing project	The first launch from Second launch pad was conducted on May 5, 2005 for PSLV C6/Cartosat-1 mission.
1.7	Space Capsule Recovery Experiment (SRE-1)	Develop a recovery capsule and demonstrate the technology for recovery and conduct micro-gravity experiments.	9.36	<ul style="list-style-type: none"> <li>o Realisation of deceleration and flotation system after air drop tests (II quarter)</li> <li>o SRE module integration, assembly testing. (III quarter)</li> <li>o Launching of SRE by PSLV C7 (III quarter).</li> </ul>	Approved / Ongoing project	

Department of Space

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1.8	INSAT-3 satellites	Development and launch of third generation INSAT-3 satellites (INSAT-3A to 3E) to augment the capacity of INSAT system.	71.10	<ul style="list-style-type: none"> <li>o Fabrication and assembly of 6 channel Imager and 19 channel Sounder payloads (Meteorological payloads) for INSAT-3D (IV quarter)</li> <li>o Fabrication and testing of spacecraft subsystems (III quarter)</li> <li>o Commencement of Assembly, integration and testing of the spacecraft in disassembled mode. (IV quarter)</li> </ul>	Approved / Ongoing project	INSAT-3A, 3B, 3C & 3E satellites in INSAT-3 series have already been launched successfully and are being used operationally.
1.9	INSAT-4 (A&B) Spacecraft Project	Development of first two satellites INSAT-4A and 4B in the fourth generation INSAT series, to augment the INSAT system capacity with high power Ku and C band transponders enabling DTH services in the country.	54.00	<ul style="list-style-type: none"> <li>o Readiness of INSAT-4A satellite for launch (I quarter)</li> <li>o Transportation of INSAT-4A to launch site (II quarter)</li> <li>o Subsystem fabrication and satellite integration for INSAT-4B satellite (IV quarter)</li> </ul>	Approved / Ongoing project	The launch of INSAT-4B may marginally spillover to first quarter of 2006-07.
1.10	INSAT-4 (A&B) Launch Services	Launch service and on-orbit insurance of INSAT-4A and 4B satellites	60.00	Placement of insurance contract and Launching of INSAT-4A satellite from Ariane launch vehicle, Kourou, French Guiana (II quarter)	Approved / Ongoing project	

Department of Space

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1.11	INSAT-4C Spacecraft Project	Development of 2T class INSAT-4C satellite to augment the INSAT system capacity with Ku band transponders.	50.00	<ul style="list-style-type: none"> <li>o Fabrication and testing of Ku band transponders (III quarter)</li> <li>o Fabrication of spacecraft subsystems and testing. (III quarter)</li> <li>o Spacecraft integration and checkout (IV quarter)</li> <li>o Transportation to launch site. (IV quarter).</li> </ul>	Approved / Ongoing project	INSAT-4C will be launched onboard GSLV F 02 from Satish Dhawan Space Centre, Sriharikota.
1.12	GSAT-3 (Edusat)	Development and launch of 2T class GSAT-3 Edusat satellite to enable satellite based distance education in the country.	5.25	Post launch operational support for EDUSAT	Approved / Ongoing project	EDUSAT has been successfully launched on 20th Sep 2004 onboard India's GSLV F01.
1.13	GSAT-4	Development and launch of GSAT-4 for advanced communication applications in Ka band.	22.50	<ul style="list-style-type: none"> <li>o Development of Ka band and navigational payload systems (III quarter)</li> <li>o Finalisation of Ka band antenna configuration (II quarter)</li> <li>o Spacecraft subsystem fabrication and testing (IV quarter)</li> </ul>	Approved / Ongoing project	GSAT-4 is planned for launch in 2006-07.
1.14	IRS-P5 (Cartosat-1)	Design, development and launch of Cartosat-1 satellite for Cartographic mapping for rural and urban applications.	1.00	Launch and operationalisation of Cartosat-1 onboard PSLV C6 in I quarter.	Approved / Ongoing project	Cartosat-1 has been successfully launched onboard PSLV C6 on May 5, 2005.

Department of Space

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1.15	IRS-2A (Cartosat-2)	Design, development and launch of IRS-2A (Cartosat-1) satellite for advanced cartographic applications.	10.40	<ul style="list-style-type: none"> <li>o Readiness of payload camera system (II quarter)</li> <li>o spacecraft integration and testing (IIIquarter)</li> <li>o launching of the satellite onboard PSLV C7 (III quarter).</li> </ul>	Approved / Ongoing project	
1.16	Radar Imaging Satellite	Dev. and launch of Radar Imaging Satellite with active microwave sensors providing all-weather remote sensing capability for critical applications in Agriculture and Disaster Mgt.	125.80	<ul style="list-style-type: none"> <li>o Completion of preliminary design review (II quarter)</li> <li>o Development and qualification of payload modules (IV quarter)</li> <li>o Spacecraft subsystem design and development (III quarter)</li> <li>o Initiation of Flight Model units fabrication. (IV quarter)</li> </ul>	Approved / Ongoing project	
1.17	Planetary Mission - Chandrayaan	To undertake Indian Lunar Mission - Chandrayaan for high resolution imaging and chemical mapping of the lunar surface.	106.22	<ul style="list-style-type: none"> <li>o Finalise the payloads of oppportunity (I quarter)</li> <li>o finalisation of spacecraft design and completion of preliminary design review. (II quarter)</li> <li>o Design review of Deep Space Network Antenna (III quarter)</li> <li>o Initiation of hardware realisation. (IV quarter)</li> </ul>	Approved / Ongoing project	Payloads of opportunity have been finalised. The contract for Deep Space Network Antenna has been awarded. An impactor payload is also included in Chandrayaan mission, planned for launch in 2007-08.

Department of Space

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1.18	Megha- Tropiques	A joint ISRO-French mission to study the water cycle and energy exchanges in tropical regions.	8.00	<ul style="list-style-type: none"> <li>o Finalisation of configuration and interface details. (II quarter)</li> <li>o Completion of preliminary design review. (III quarter)</li> <li>o Initiation of FM hardware realisation (IV quarter).</li> </ul>	Approved / Ongoing project	
1.19	ASTROSAT	Development and launch of multi-wavelength Astronomy satellite ASTROSAT for studies related to high energy X-ray astronomy.	52.90	<ul style="list-style-type: none"> <li>o Spacecraft design and configuration finalisation (II quarter)</li> <li>o initiation of payload development. - proportional counters and detectors (II quarter)</li> <li>o Completion of Preliminary design review.(III quarter)</li> </ul>	Approved / Ongoing project	
	<b>Subtotal - 1</b>		<b>1352.32</b>			

Department of Space

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<b>2</b>	<b>MAJOR PROJECTS (to be sanctioned)</b>					
2.1	INSAT-4 / GSAT follow-on satellites	Development of 2T class INSAT-4D/GSAT-5 to augment the INSAT system with C band transponders and Development of INSAT-4E/GSAT-6 satellites to enable introduction of satellite based mobile multi-media services.	50.00	<ul style="list-style-type: none"> <li>o Initiation of communication transponders and spacecraft subsystem fabrication for INSAT-4D/GSAT-5 (II quarter)</li> <li>o Finalisation of configuration for INSAT-4E/GSAT-6 (IV quarter).</li> </ul>	INSAT-4D/GSAT-5 already approved. Proposal for INSAT-4E/GSAT-6 under process for approval. Cabinet approval expected by October 2005.	INSAT-4D is scheduled for launch in 2006-07.
2.2	Oceansat-2	Development and launch of Oceansat-2 for Oceanography and coastal studies and providing continuity of services for Oceansat-1.	50.00	<ul style="list-style-type: none"> <li>o Finalisation of configuration (II quarter)</li> <li>o Initiation of Ku band scatterometer and Ocean color monitor payload development. (III quarter)</li> <li>o Spacecraft subsystem design and development. (IV quarter)</li> </ul>	Approved recently in June 2005.	Launch planned in 11th plan period.



Department of Space

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2.3	Resourcesat-2	Development of Resourcesat-2 for natural resource management applications and provide continuity of services with improved capabilities.	5.00	<ul style="list-style-type: none"> <li>o Finalisation of Project Report (III quarter)</li> <li>o Procurement of payload components.(IV quarter)</li> </ul>	Cabinet approval targeted by February, 2006.	Launch planned in 11th plan period.
2.4	Satellite Navigation	To develop a constellation of Indian Regional navigational satellite system (IRNSS) for providing positioning services and explore possibility of participation in global system.	350.00	<ul style="list-style-type: none"> <li>o Finalisation of spacecraft configuration and preliminary design. (III quarter)</li> <li>o Initiation of spacecraft subsystems design and navigational payload development. (IV quarter)</li> <li>o Participation in global systems (IV quarter)</li> </ul>	Cabinet approval for IRNSS expected by October 2005.	IRNSS Proposal cleared by Planning Commission. (Cost: Rs. 1420 crores)
2.5	Space Capsule Recovery Experiment follow-on (SRE-2)	Develop a recovery capsule and demonstrate the technology for recovery and conduct micro-gravity experiments as a follow on for SRE 1.	5.00	Procurement of materials for thermal protection system, propulsion system and structures.(IV quarter)	Approval of Space Commission by Feb 2006.	Proposal to be formulated.
	<b>Subtotal - 2</b>		<b>460.00</b>			

Department of Space

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<b>3</b>	<b>Pre-Project R&amp;D / Activities</b>					
3.1	Advanced Communication Technology initiatives	To develop communication technologies in Ka band for data broadcast services	28.50	Design and fabrication of Ka band components (base band processors, receivers, upconverters demodulators, switch matrix, etc.,) and associated test systems. (IV quarter)	Approved / Ongoing project	
3.2	MMIC based receiver development	To indigenously develop state of art, highly reliable, repeatable MMIC (Monolithic Microwave Integrtd Circuits) based C band and Ku band receivers for communication satellites.	4.20	Complete the development of C band MMIC receiver by III quarter and Ku band receiver by IV quarter.	Approved / Ongoing project	
	<b>Subtotal - 3</b>		<b>32.70</b>			

Department of Space

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<b>4</b>	<b>Major application programmes</b>					
4.1	Remote Sensing Applications (incl. NNRMS, EOAM, NRSA, NESAC)	To develop applications of remote sensing data for natural resource management and other developmental applications in tune with the national needs.	81.00	In a phased manner, <ul style="list-style-type: none"> <li>o Conduct Natural Resource Census - land, water, soil, forests and other resources - to provide a snap shot of the country's natural resources.</li> <li>o To create large scale cartographic quality maps as base maps.</li> <li>o Training programmes in remote sensing at Indian Institute of remote sensing, Dehradun.</li> <li>o Pilot studies in remote sensing applications - cropping system analysis, snow and glacier investigations, coastal zone management, etc.,</li> <li>o Studies on Ocean state monitoring, satellite meteorology, Ocean color and biological oceanography, etc.,</li> </ul>	Approved / Ongoing programme	Several remote sensing application missions of national importance are currently in progress including National Drinking Water Mission, Bio-diversity characterisation at landscape level, Waste land mapping, integrated water resource management, Potential fishing zone forecasting, etc.,

Department of Space

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4.2	Disaster Management Support	To provide space based inputs and services on a timely and reliable basis for the disaster management support in the country.	25.00	<ul style="list-style-type: none"> <li>o Development and deployment of 50 numbers of emergency communication terminals ( III quarter).</li> <li>o establishment of virtual private n/w connecting Ministry of Home Affairs with 20 district nodes for disaster management support (IV quarter)</li> <li>o Development of an airborne synthetic aperture radar for disaster management applications (IV quarter).</li> </ul>	Approved / Ongoing programme	
4.3	SATCOM application programme	To carryout application experiments / projects / technology demonstration systems in satellite communications including development communications.	43.26	<ul style="list-style-type: none"> <li>o Establishment of GAGAN ground segment facilities for satellite navigation. (IV quarter)</li> <li>o Initiation of ground terminals for development of applications in Ka band. (II quarter)</li> </ul>	Approved / Ongoing programme	

Department of Space

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4.4	Space Science and Environment (including PRL, NMRF)	To carry out front-ranking investigations in the new, emerging and challenging areas of space science research including microgravity research.	56.10	<ul style="list-style-type: none"> <li>o Establishment of national infrastructural facilities for planetary exploration studies.</li> <li>o Conduct of atmospheric research using MST radars.</li> <li>o Global change studies.</li> <li>o Multi-disciplinary research in Astronomy, astrophysics, geo sciences, theoretical physics and complex systems and quantum information.</li> </ul>	Approved / Ongoing programme	
4.5	<b>INFORMATION TECHNOLOGY (IT)</b>					
	(A) Natural Resource Data base / Information system	Establishment of a national level Natural Resource Data Base with distributed GIS data servers to aid natural resource management in the country.	4.00	Preparation of land use / land cover map of the whole country using IRS data on 1:250,000 scale. (III quarter)	Approved / Ongoing programme	One season (Khariff 2004) IRS data has been analysed for assessment of cropping pattern.

Department of Space

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	(B) GRAMSAT Developmental Network & VRCs	To provide various space enabled services such as tele-medicine, tele-education (nonformal), geospatial information on natural resources, environment in an integrated manner through establishment of Village Resource Centres.	40.00	To establish 100 VRCs in the country in first phase. (III quarter: 50 numbers IV quarter: 50 numbers)	Approved / Ongoing programme	VRC is a recent initiative of DOS and the first cluster of three VRCs in TN were set up in October 2004. Recently, on July 6, 2005, a cluster of 12 VRCs launched jointly by ISRO and Amrital Vishwa Vidya peetham was inaugurated by Hon'ble President of India.
	(C) EDUSAT Utilisation Network	Develop and demonstrate the concept of satellite based multicasting interactive multimedia for education in schools, colleges, teachers training and non-formal education.	40.00	<ul style="list-style-type: none"> <li>o Operationalisation of the network connecting 880 primary schools in Chamarajnar, Karnataka. (I quarter)</li> <li>o Expansion of the EDUSAT network with additional 1500 interactive terminals for various schools and colleges. ( III quarter: 500 numbers ; IV quarter: 1000 numbers)</li> </ul>	Approved / Ongoing programme	The Chamarajnar network has been made operational and the programmes are being transmitted through the network regularly.

Department of Space

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	(D) Tele-medicine Network	Establishment of satellite based tele-medicine centres connecting rural district hospitals with super speciality hospitals, enhancing the health infrastructure in the country.	12.00	Setting up of additional 100 telemedicine centres during the year - I quarter : 30 nos; II quarter : 20 nos; III quarter: 15 nos; IV quarter: 35 nos.	Approved / Ongoing programme	As on March 2005, the Telemedicine network has 100 centres - 75 district hospitals connected to 25 super speciality hospitals.
	<b>Subtotal (IT)</b>		<b>96.00</b>			
	<b>Subtotal - 4</b>		<b>301.36</b>			
5	Technology Development Programme / R & D including development of small / micro satellites and development of semiconductors technology	To develop the technology base required for future satellite and launch vehicle missions .	103.11	<ul style="list-style-type: none"> <li>o Launch and operationalisation of HAMSAT - an application specific micro satellite for satellite based radio amateur services. (I quarter)</li> <li>o Initiate development of a small satellite                             <ul style="list-style-type: none"> <li>- Third World Satellite (TWSAT) for providing remote sensing data to third world countries.(II quarter)</li> </ul> </li> <li>o Development of airbreathing propulsion technology, initiatives on reusable launch vehicle systems, advanced materials for reusable systems, stationary plasma thrusters for propulsion, advanced inertial systems for launch vehicles and satellites, Ka band propagation experiments and mm wave sounders.</li> </ul>	Approved / Ongoing programme	<ul style="list-style-type: none"> <li>o HAMSAT has been successfully launched onboard PSLV C6 on May 5, 2005.</li> <li>o The administrative control of Semiconductor Complex has been transferred from Dept. of IT to Dept. of Space w.e.f March, 2005.</li> </ul>

Department of Space

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6	Technical Facilities Replacement / Augmentation	To build and maintain state-of-art infrastructural facilities in Centre / Units to support the Launch vehicles, Satellite and Ground Systems.	244.70	Augmentation of technical infrastructure with 6.5m dia thermo vacuum chamber for spacecraft testing, Wind tunnel facility for launch vehicle development, fast response angular motion simulator for design validation, vibration control systems for testing and modernisation of ground tracking network.	Approved / Ongoing programme	These are activities which continue throughout the year.
7	Dev. of Space materials and Components including Semiconductor devices /Advance Ordering	To indigenously develop selected space materials and components through Indian Industry and stockpile strategic/critical components/materials for future use.	59.98	Development of Space components and materials - specifically Application specific integrated circuits, Travelling Wave Tube Amplifiers, Radiation hardened electronic components, Charge Coupled Devices and Chemical cells.	Approved / Ongoing programme	These are activities which continue throughout the year.
8	Technical and Auxiliary Facilities Support	To operate and maintain the IRS, INSAT & GSAT satellites in orbit and to provide design, development, testing and fabrication support for realisation of space systems hardware.	220.80	<ul style="list-style-type: none"> <li>o Tracking network operations for IRS, INSAT, GSAT and Kalpana satellites.</li> <li>o Testing of INSAT -4B, 4C, GSAT -4, Cartosat-2 and RISAT satellites.</li> <li>o Fabrication and testing support for launch vehicle development and production through PSLV and GSLV.</li> </ul>	Approved / Ongoing programme	These are activities which continue throughout the year.



Department of Space

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9	Other Schemes	To strengthen interface with academia (for R & D related to Space), industry for production (of space hardware) and forge strategic international partnership in space programme.	25.03	<ul style="list-style-type: none"> <li>o Sponsored projects at Universities / institutes (180 projects).</li> <li>o Training programme for international participants through UN Centre.</li> <li>o Productionisation of transducers and solar panels, thermal control materials for spacecraft.</li> </ul>	Approved / Ongoing programme	These are activities which continue throughout the year.
	<b>TOTAL - PLAN</b>		<b>2800.00</b>			

**NOTE: Department of Space, being a Scientific Department, has significant component of technology development / R & D and it is not feasible to indicate quantifiable deliverables, sought in column 5, for all the programmes. Wherever feasible, like in Tele-medicine, Village Resource Centres, EDUSAT utilisation terminals, etc., quantifiable deliverables have been indicated. For all other programmes, developmental targets which are monitorable have been indicated.**