CHAPTER – IV

Department of Space

4.1 Inordinate delay in realisation of SRE-2 mission

The launch of Space Capsule Recovery Experiment - 2 mission of Department of Space, originally scheduled for August 2008 was delayed by more than five years. This resulted in wasteful expenditure of ₹52 lakh due to expiry of parachutes and floats procured for the mission and non-achievement of objectives of the mission as of March 2014 in spite of incurring expenditure of ₹30.66 crore on the mission.

Space Capsule Recovery Experiment (SRE) is a project of the Department of Space (DOS) to demonstrate certain key technologies for re-entry and recovery of the space capsules as well as to provide a platform for microgravity experiments. The experimental satellite SRE-1 was launched in January 2007. This was to be followed by the SRE-2 mission, which was approved earlier (November 2005) by the Space Commission at a cost of ₹30 crore. The planned duration of the project was 18 months i.e. up to August 2008. The main objective of SRE-2 mission was to carry out microgravity experiments in the area of material and life science and use of indigenously developed advanced Carbon-Carbon thermal protection system in the nose cap region of the capsule.

SRE capsule

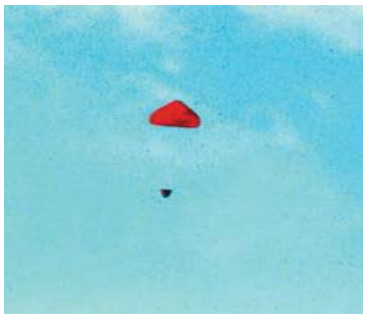
The SRE-2 capsule was to be launched by Vikram Sarabhai Space Centre, Thiruvananthapuram (VSSC), a unit of DOS responsible for realisation of satellite launch vehicles and associated technologies. Due to technical issues in the development of thermal protection system for the capsule, VSSC proposed (September 2010) to procure the items from abroad. Based on the proposal of VSSC, the project cost was revised (October 2010) to ₹42 crore and the launch schedule was extended to mid 2011. As of March 2013, expenditure of ₹30.66 crore was incurred on the project. An amount of ₹11.34 crore was further required to meet expenditure towards balance payment on bioreactor payload, launch recovery operation charges and miscellaneous balance payment on purchase orders and contingencies.

Audit observed that although a launch vehicle was available in 2011, SRE-2 mission was not realised as the SRE-2 capsule was not ready due to non-availability of carbon-carbon nose cap. The launch vehicle was used to launch (2011) other Indian and foreign satellites. Launch schedule of SRE-2 mission was deferred to June 2014.

Deferring the launch schedule of the project resulted in delay of more than five years in realisation of the mission after incurring expenditure of ₹30.66 crore. The delay also led to wasteful expenditure due to expiry of mission consumables, as discussed below:

Wasteful expenditure in procurement of parachutes and floats

The space capsule was to be in space for a maximum period of 30 days during which the microgravity experiments were to be conducted. Thereafter, it was to be brought back to the earth and eventually recovered from the sea. Upon its return to the earth's atmosphere, a parachute and floatation system was to be used for touchdown in the sea.



Re-entry of space capsule

VSSC entered (March 2008) a Memorandum of Understanding (MOU) with Aerial Delivery Research and Development Establishment, Agra (ADRDE) towards supply of parachutes and floats for SRE-2 mission at a total cost of ₹52 lakh. According to the terms of the MOU, 50 *per cent* of the total value was to be paid as advance on signing the MOU and balance after Flight Readiness Review (FRR). The advance payment of ₹26 lakh was released (March 2008) on signing the MOU. VSSC received (2009) six sets of floats and four sets of parachutes and released (March 2010) balance payment of ₹26 lakh after conducting FRR.

Space capsule recovery from sea

In the meantime, the shelf life of the floats and parachutes expired in October 2012 and November 2013 respectively. As a result, expenditure of ₹ 52 lakh incurred by VSSC on parachutes and floats was rendered wasteful. DOS admitted (April 2014) that the materials would not be used in the mission.

Thus, deferring the launch schedule of SRE-2 mission resulted in delay of more than five years in realising the mission even after incurring expenditure

of ₹30.66 crore. Parachutes and floats procured at a cost of ₹52 lakh exceeded their shelf life and were ultimately not used, resulting in wasteful expenditure.

VSSC stated (April 2013) that the schedule given for financial sanction of projects was an indicative schedule and the operational schedule was prepared considering the national priorities and agreements with other end users. DOS further added that in the year 2011, though PSLV vehicle was identified and available for the launch of SRE-2 mission, the capsule was not ready for launch due to non-availability of the indigenous carbon-carbon thermal protection system.

The reply indicates a mismatch between financial and operational planning for launch of satellites, which is significant in the overall context of shelf life of the mission payloads. The reply of VSSC/DOS may also be viewed in the light of the fact that decision to procure the carbon-carbon nose cap from abroad due to inability to develop it indigenously was taken as far back as September 2010. However, as of April 2014, VSSC had been unable to realise the nose cap. Further, as of March 2014, flight units for SRE-2, though realised, were not assembled. Testing of integrated electronics packages, proposed to be done one year before the scheduled flight, had also not commenced.

The SRE-2 mission was, thus, inordinately delayed and the launch schedule had still not been firmed up as of March 2014 leading to non-realisation of objectives of the mission for more than five years in spite of incurring expenditure of ₹30.66 crore, besides wasteful expenditure of ₹52 lakh due to expiry of mission consumables.

4.2 Loss in allocation of satellite capacity

Indian Space Research Organisation, Department of Space provided communication satellite capacity free of cost to the Government of Andhra Pradesh in violation of the decision of the Government of India to charge all users of satellite services, resulting in loss of revenue to the tune of ₹19.16 crore.

Indian Space Research Organisation (ISRO), Department of Space (DOS) has the primary objective of promoting the development and application of space science and technology. One of the major satellite systems operationalised by ISRO is Indian National Satellites (INSAT), which is used for various communication services. Initially, satellite capacity to Government users on INSAT system was being provided free of cost. Based on the direction of Ministry of Finance and Planning Commission, INSAT Coordination

Committee[24] (ICC), recommended (January 2002) that all users of INSAT system, including Government users, should be charged for allocation of satellite capacity. The Standing Committee constituted for the purpose fixed (July 2002), a minimum floor rate of ₹2.50 crore per transponder[25] per annum.

ISRO entered (July 2000) into a Memorandum of Understanding (MoU) with the Government of Andhra Pradesh (GOAP) to explore the possibilities of establishment of a satellite based communications network within the State of Andhra Pradesh by using the Ku band satellite capacity of INSAT system for promoting usage of satellite based communications in the areas of distance education, telemedicine, agricultural extension, e-governance, self help groups, marketing and human resource development, community internet centres, etc. ISRO and GOAP were to identify the areas of cooperation together and arrive at a definitive agreement for working together. The MoU was valid for a period of three years, with a provision for renewal for such periods as mutually agreed. The MoU was renewed further on two occasions (July 2003 and August 2006) for three years each i.e. upto August 2009.

As per MoU, ISRO was responsible for providing the required Ku band capacity in the INSAT system for a period of three years, sharing of expertise and experience and extending technical guidance and support. Accordingly, ISRO allocated (2000) satellite capacity of 29 MHz to GOAP from its satellite INSAT-3B and the services, named SAPNET-Mana TV[26] became operational. Audit observed that though the MoU with GOAP expired in August 2009, ISRO continued to provide INSAT capacity for SAPNET services. Further, at the end of the orbital life of INSAT-3B, ISRO hired (June 2010) 13 MHz of satellite capacity from the foreign satellite NSS-12[27] from July 2010 to March 2012 for providing to GOAP and incurred expenditure of ₹4.02 crore as transponder hiring charges. After the launch of its own satellite G-SAT-8 (May 2011), ISRO subsequently vacated the foreign satellite capacity and allocated (April 2012) 17 MHz capacity on G-SAT 8.

[24] INSAT Coordination Committee (ICC) is an interdepartmental coordination mechanism constituted by the Cabinet Secretariat for planning and allocation of communication satellite capacity from INSAT system.

[25] One transponder is equivalent to 36 MHz bandwidth.

[26] Society for Andhra Pradesh Network, which was registered (March 2003) as a non-profit society funded by GOAP, for operating Mana TV services.

[27] New Skies Satellites, renamed as SES World Skies, having its headquarters in Netherlands/ USA.

Chronology of events in the allocation of satellite capacity for SAPNET-Mana TV	
Date	**Event**
July 2000	Memorandum of Understanding (MoU) entered between Indian Space Research Organisation (ISRO) and Government of Andhra Pradesh (GOAP) for establishment of a satellite based communications network within the state of Andhra Pradesh using the Ku band satellite capacity of INSAT system in the areas of distance education, telemedicine, agricultural extension, e-governance, self help groups, marketing and human resource development, community internet centres, etc.
2000	ISRO allocated satellite capacity of 29 MHz to GOAP from its satellite INSAT-3B and the services, named SAPNET-Mana TV became operational
January 2002	Based on the direction of Ministry of Finance and Planning Commission, INSAT Coordination Committee (ICC), recommended that all users of INSAT system, including Government users, should be charged for allocation of satellite capacity by ISRO/DOS.
July 2002	The Standing Committee constituted for the purpose fixed a minimum floor rate of ₹2.50 crore per transponder per annum.
July 2003	MoU was extended for a further period of three years.
August 2006	MoU was extended for a further period of three years.
August 2009	MoU between ISRO and GOAP expired.
June 2010	ISRO hired satellite capacity from the foreign satellite NSS-12 from July 2010 to March 2012 for GOAP.
May 2011	GSAT-8 satellite launched.
April 2012	ISRO vacated capacity in NSS-12 and allocated 17 MHz capacity on GSAT- 8 to SAPNET.

Audit further observed that after expiry (July 2003) of the first MoU, though ISRO renewed the MoU with GOAP twice for three years each, i.e upto August 2009, it did not charge from GOAP for the satellite capacity allocated. Even beyond August 2009, despite the expiry of MoU, ISRO continued to provide satellite capacity to GOAP free of cost, even by hiring capacity from abroad and incurring charges thereby. Audit also noted that ISRO did not enter into a definite agreement with GOAP as envisaged in the initial MoU.

Allocation of satellite capacity free of cost to GOAP in violation of DOS policy resulted in loss of ₹19.16 crore[28] including ₹4.02 crore paid to the foreign satellite owner, for the period from July 2003 to March 2013.

[28] Calculated for the period from 25 July 2003 to 30 June 2010 (29MHz on INSAT-3B) and from 01 April 2012 to 31 March 2013 (17 MHz on G-SAT 8) at the rate of ₹2.5 crore per transponder per annum added with ₹4.02 crore paid to foreign satellite owner for the period from 1 July 2010 to 31 March 2012 (12 MHz on NSS-12).

ISRO replied (August 2013) that satellite capacity was allocated for societal programmes such as tele-education, tele-health and developmental communication networks in association with State Governments and its agencies and added that the decision of ICC was to charge from revenue earning departments such as BSNL[29], Doordarshan, etc. While reiterating this position, DOS further stated (May 2014) that usage of APNET for educational purpose by GOAP was in line with approach of DOS/ISRO for supporting societal programmes by transferring bandwidth free, as was being followed in other States.

The reply of ISRO/DOS is not acceptable, as the decision of the Government of India was to charge for satellite capacity from all users including Government departments/societal programmes. Audit also noted that ISRO had collected satellite capacity charges from other Central and State Government non-commercial departments such as Ministry of Defence at the rate of ₹3.39 crore per transponder per year for lease of 4 MHz of C Band capacity on INSAT 3E satellite during 2008-11 and from the Government of Chattisgarh at the rate of ₹5.44 crore per transponder per year for lease of 4 MHz of Ku Band capacity on INSAT 4CR satellite during 2009-2011. Further, SAPNET was also earning revenue by rendering some of its services on payment basis.

Thus, providing satellite capacity to GOAP free of cost was not only in violation of the decision of the Government but was also against the principles of fairness, equitable treatment and objectivity in the allocation of satellite capacity. Non-conformity with Government decision also resulted in loss of revenue to the tune of ₹19.16 crore to ISRO.

4.3 Avoidable expenditure due to improper contract management

ISRO Satellite Centre, Bengaluru included price escalation clauses in two fabrication contracts entered with Hindustan Aeronautics Limited, without specifying definite time periods for completing the fabrication works. Further, after three years from the date of signing the contracts, it amended the contracts by increasing the fixed ceiling of man hours without changing the scope of work. The improper contract management resulted in avoidable expenditure of ₹4.35 crore.

ISRO Satellite Centre (ISAC), Bengaluru under Indian Space Research Organisation (ISRO), is responsible for conceptualisation, design, fabrication, testing, integration and in-orbit commissioning of satellite systems.

[29] Bharat Sanchar Nigam Ltd.

As a part of the co-operative efforts for the ISRO Programmes, ISRO established (May 1983) a dedicated facility named Aerospace Division (ASD) at Hindustan Aeronautics Limited (HAL) for fabrication of structural assemblies required for GEOSAT[30]/IRS[31] space programmes with the help of the technical manpower of HAL.

Fabrication of INSAT 4C

ISAC awarded (March 2004) two contracts to HAL for fabrication of three types of 10 structural final assemblies for GEOSAT spacecraft programme and five types of 16 structural assemblies for IRS spacecraft programme, along with brackets and miscellaneous components. The two fabrication contracts prescribed a ceiling of 60,000 man hours each, covering the entire scope of fabrication work. The man hour rate was fixed at ₹700, which would remain constant till 2005-06 and thereafter subject to escalation by seven *per cent* of the rate applicable for the previous year. The validity of both contracts was for four years i.e upto March 2008 or till completion of structures, whichever was later.

Audit observed that ISAC did not specify the yearly deliverables for the structural assemblies in the contracts but left the delivery period open-ended. Although as per the contracts, a mutually agreed delivery schedule was to be worked out from time to time, however, no work orders specifying the scope of work and delivery schedules were issued to HAL.

Audit further observed that after completing three years from the date of signing of the contracts, ISAC amended (March 2007) both the contracts by raising the ceiling for contracted man hours in the GEOSAT and IRS contracts to 95,000 hours and 75,000 hours, respectively without any corresponding increase in the scope of work under the firm and fixed contracts.

HAL delivered the final assemblies under the GEOSAT contract between May 2004 and February 2010, after clocking 94,941.31 man hours and completed the deliveries under IRS contract between October 2004 and December 2011 after clocking 74,145.39 man hours. A total payment of ₹12.58 crore was made to HAL under both contracts, of which ₹4.13 crore was on account of increase in the contracted man hours. Further, in spite of the delay of nearly

[30] Geostationary Satellite (GEOSAT)

[31] Indian Remote Sensing (IRS)

two years and three years in completing the GEOSAT and IRS contracts respectively, HAL was benefitted to the extent of ₹21.58 lakh due to the man hour escalation clause. The details of man hours, rates including escalated rates for both contracts are given in the ***Appendix IX***.

Thus, by leaving the delivery period open ended while simultaneously inserting an escalation clause in the contracts for increasing the man hour rate beyond 2005-06, ISAC extended an advantage to HAL by committing to pay at the escalated man hour rate even in the event of delay in completion of the works. This was also in violation of the General Financial Rules[32].

ISAC accepted (July 2009) that there was no change in the scope of the work and stated that the addition of man hours were included to increase the share of work at HAL and facilitate better management of the contracts. DOS added (June 2014) that bonding of some of the components were given to HAL as additional work, however, it was not included in the revised agreement as the increase in the work was reflected through modified drawings supplied to HAL. DOS further stated (June 2014) that there was no advantage to the contractor as the man hours booked for fabrication of each component and the delivery schedules of structures were certified by ISAC. With regard to escalation of man hour rates, ISAC agreed (July 2014) that the differential amount would be recovered from HAL.

The reply of DOS regarding addition of man hours is not tenable, as the ceiling on man hours initially fixed in the contracts was for the complete fabrication work under the contracts and any further increase in the share of work of HAL should have been duly incorporated in the amendment to the contract, which was not done. Incorporating provisions for escalation in contracts having no definite delivery period and review of charges without specifying the period of review reflects poor contract management and is also in violation of General Financial Rules.

Thus, deficient contract management by ISAC resulted in avoidable expenditure of ₹4.35 crore under the two fabrication contracts.

[32] Rule 204 of the General Financial Rules stipulates that the terms of a contract should be precise, definite and without ambiguity. It also prescribes that where a price variation clause is provided, the price agreed upon should specify the base level viz., the month and year to which the price is linked, to enable variations being calculated with reference to the price levels prevailing in that month and year.

4.4 Infructuous expenditure on procurement of components

ISRO Satellite Centre failed to properly assess requirement of solid state switches for use in a project. The switches were eventually not used in the project, thereby resulting in infructuous expenditure of ₹1.47 crore incurred on their procurement.

ISRO Satellite Centre (ISAC), a unit of Department of Space (DOS), raised (November 2007) a purchase indent for procurement of Si2-124 Solid State Switches from Si2 Microsystems Limited, Bengaluru on proprietary basis with the purpose of developing alternate vendor to meet increasing demand of the switches in Indian Regional Navigational Satellite System (IRNSS) project. The purchase order was placed (October 2008) on the firm for design and development of 50 solid state switches including 30 numbers of 42 Voltage and 20 numbers of 70 Voltage devices at a total cost of ₹1.60 crore. The firm was required to supply prototypes of the switches within four to five months for clearance by ISAC followed by production units within six to eight months from the purchase order date i.e by April/June 2009.

The supplier sought extension of time citing technical reasons and supplied (January 2010) two prototypes each of 42 Voltage and 70 Voltage device for production approval along with test-jig and test results of prototype. ISAC cleared (February 2010) the prototype for batch production with some recommendations for improvement in the test jig. However, the supplier requested for further extension of time up to June 2010 for delivering the assembled switches and subsequently supplied 23 switches of 42 Voltage and 19 switches of 70 Voltage in June and July 2010 respectively. This extension was provided without imposition of liquidated damages.

In July 2010, the supplier again requested for extension of time for supply of packages due to lead time required to build the remaining devices or else to short close the order. ISAC recommended (August 2010) short closure of the order and paid amount of ₹1.47 crore to the supplier. ISAC justified (February 2013) the short closure of the order by stating that the solid state switches procured for IRNSS project were decided not to be used and instead, conventional packages were used.

Audit observed that ISAC did not follow the due diligence process for identification and selection of the vendor. Although ISAC was aware of the existence of four hybrid circuit manufacturers in India supplying these products, it selected Si2 Microsystems Ltd. on proprietary basis without following tender route and without recording internal discussions based on which the decision to procure the switches from the firm was taken. Further, short closure of the order on the ground of non-usage of switches for the

project was contrary to the justification given in the indent which was raised to meet the increasing demand of the same. Audit further observed that though ISAC decided to use conventional packages as early as January 2010, it cleared the prototype for batch production in February 2010 and took receipt of 42 switches at a cost of ₹1.47 crore.

The selection of vendor without following due process and injudicious clearance of prototype after deciding not to use the switches in the IRNSS project resulted in non-utilisation of the switches for the intended purpose and infructuous expenditure of ₹1.47 crore. Further, alternate indigenous vendor as envisaged could also not be developed.

ISAC stated (June 2013) that it had used some of these devices in engineering model development for heater drivers and performance was satisfactory. It further stated that ISAC had gained expertise and technological challenges in this field and developed alternate indigenous vendor. While accepting that the order was short closed due to technical problems encountered by the vendor, DOS added (May 2014) that the 42 Voltage switches were planned to be used in on board simulation models for ground testing and 70 Voltage devices were planned to be used for future simulation requirements of RISAT[33] follow-ons. The reply of ISAC/DOS needs to be viewed in light of the fact that ISAC had developed the indigenous vendor for manufacture of solid state switches and cleared the batch production for IRNSS project in spite of deciding not to use the same in the project. Moreover, the 70 Voltage switches are yet to be put to any use.

Thus, failure of ISAC to properly assess requirement of solid state switches resulted in infructuous expenditure of ₹1.47 crore incurred on procurement of the switches.

[33] Radar Imaging Satellite