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AVOIDABLE PROCUREMENT OF A MOBILE NITROGEN GAS GENERATOR PLANT; INFRUCTUOUS PROCUREMENT OF MATERIAL; DEVELOPMENT OF INTEGRATED AEROSTAT SURVEILLANCE SYSTEM; AND IRREGULAR EXPENDITURE ON CONSTRUCTION OF VEHICLE TESTING GROUND

MINISTRY OF DEFENCE

PUBLIC ACCOUNTS COMMITTEE
(2018-19)

ONE HUNDRED AND THIRTY FIRST REPORT

SIXTEENTH LOK SABHA

LOK SABHA SECRETARIAT
NEW DELHI

PAC NO. 2170

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MINISTRY OF DEFENCE

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L O K S A B H A S E C R E T A R I A T
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INTRODUCTION

I, the Chairperson, Public Accounts Committee, having been authorized by the Committee, do present this One Hundred and Thirty First Report (Sixteenth Lok Sabha) on **"Avoidable Procurement of a Mobile Nitrogen Gas Generator Plant; Infructuous Procurement of Material; Development of Integrated Aerostat Surveillance System; and Irregular Expenditure on Construction of Vehicle Testing Ground"** based on Para Nos. 6.1 and 6.2 of the C&AG's Report Nos. 19 of 2016 and 15 of 2017, respectively, relating to the Ministry of Defence.

2. The above-mentioned Reports of the Comptroller and Auditor General of India were laid on the Table of the House on 26th July, 2016 and 21st July, 2017, respectively.

3. The Sub-Committee-I (Defence) of the Public Accounts Committee (2017-18) took up the subjects relating to Para Nos. 6.1 and 6.2 of the C&AG's Report No. 19 of 2016 for detailed examination and report. The Sub-Committee took evidence of the representatives of the Ministry of Defence (MoD) and Defence Research and Development Organization (DRDO) on the subjects at their sitting held on 25th May, 2017. However, due to paucity of time, the subjects were carried forward to the successor Committee i.e. PAC (2018-19). The Committee took further evidence of the representatives of the Ministry of Defence (MoD) and Defence Research and Development Organization (DRDO) on the subjects at their sitting held on 15th November, 2018. The Committee (2018-19) took up the subjects relating to Para Nos. 6.1 and 6.2 of the C&AG's Report No. 15 of 2017 for detailed examination and report. The Committee took evidence of the representatives of the Ministry of Defence (MoD) and Defence Research and Development Organization (DRDO) on the subjects at their sitting held on 7th September, 2018. Accordingly, a draft Report was prepared and placed before the Committee for their consideration. The Committee considered and adopted this draft Report at their sitting held on 14th December, 2018. The minutes of the Sittings are appended to the Report.

4. For facility of reference and convenience, the Observations and Recommendations of the Committee have been printed in thick type and form Part- II of the Report.

5. The Committee would also like to express their thanks to the representatives of the Ministry of Defence (MoD) and Defence Research and Development Organization (DRDO) for tendering evidence before them and furnishing the requisite information to the Committee in connection with the examination of the subject.

7. The Committee place on record their appreciation of the assistance rendered to them in the matter by the Office of the Comptroller and Auditor General of India and the Committee Secretariat in preparation of the Report.

NEW DELHI;
December, 2018
Agrahayana, 1940 (*Saka*)

MALLIKARJUN KHARGE
Chairperson,
Public Accounts Committee.

Part - A

"AVOIDABLE PROCUREMENT OF A MOBILE NITROGEN GAS GENERATOR PLANT" AND "INFRUCTUOUS PROCUREMENT OF MATERIAL" based on Para Nos. 6.1 and 6.2 of Chapter VI of the C&AG's Report No. 19 of 2016

REPORT
PART I

I. INTRODUCTORY

1. The Committee selected Chapter VI of the C&AG's Report No.19 of 2016 relating to Defence Research and Development Organisation (DRDO) for detailed examination and report. This Chapter contains two paragraphs out of which Para 6.1 relates to Avoidable Procurement of a Mobile Nitrogen Gas Generator Plant while para 6.2 relates to Infructuous Procurement of Material.

2. The Committee learn that Para 6.1 of Chapter VI of C&AG's Report No. 19 of 2016 revealed that despite no demand from Army for Nitrogen gas generator plant, Combat Vehicles Research & Development Establishment (CVRDE) Avadi, placed an order for development of a mobile Gas Plant, at a cost of Rs. 97.33 lakh. Development of Gas Plant by CVRDE was unwarranted as the plant had already been developed by the same firm for DRDO in July 2010 and supplied to Defence Research and Development Laboratory in January 2011.

3. Further, the Committee have found that audit Para No. 6.2, which pertains to infructuous procurement of material, reveals that C-103 material did not resist the high temperature generated in the scramjet engine. Scramjet or supersonic combustion ramjet is an air breathing jet engine in which high vehicle speed is used to compress the incoming air forcefully before combustion in supersonic airflow allowing it to operate efficiently at extremely high speeds thus generating very high temperatures in the range of 2227^0C to 2527^0C. Despite knowing this fact, Defence Research and Development Laboratory procured 1329 Kg of C-103 material valuing Rs. 4.83 crore, which was unwarranted and eventually proved wasteful.

4. Against this backdrop, the Sub-Committee-I (Defence) of the Public Accounts Committee (2017-18) obtained background note and requisite replies and some other clarifications from the Ministry of Defence (MoD) and Defence Research and Development Organisation (DRDO). The Sub-Committee took oral evidence of the representatives of the MoD and DRDO on 25.05.2017 and consequently obtained

information on the subjects. However, due to paucity of time, the subject was carried forward to the successor Committee i.e. PAC (2018-19). The PAC (2018-19), took further oral evidence of the representatives of the MoD and DRDO on 15.11.2018 and obtained updated information on the subjects. Based on the information gathered, the Committee proceeded with examination of the relevant issues in detail as outlined in the succeeding chapters.

Para 6.1 Avoidable Procurement of a Mobile Nitrogen Gas Generator Plant

5. The Committee found that Combat Vehicles Research & Development Establishment (CVRDE), Avadi, in May 2010, projected requirement for procurement of mobile Nitrogen gas generator plant to produce Nitrogen gas for use in the Army's Arjun Main Battle Tank (MBT) during operations/trials in the field areas. The procurement was to be done so that during strategic operations/war scenario, the gas cylinders would be required to be positioned deep in the forward areas/war zone and the requirement could not be met by procuring gas cylinders from the open market.

6. In this sequel, CVRDE placed an order for development of a mobile gas generator plant at a cost of Rs. 97.33 lakh, despite there being no demand for nitrogen gas generator plant. Defence Research and Development Organisation (DRDO) in their Background Note, furnished to the Committee, stated as under:

> "Arjun MBT is a flagship product of CVRDE/DRDO and Nitrogen gas is very important and critical to keep the Arjun MBT in war-fit condition, necessary for achieving cushioning effect, for the functioning of the braking system under dynamic condition and to keep the Gunners Main Sight moisture free. Unavailability of Nitrogen gas will affect both the mobility and firing capabilities, which are all mission critical features of the tank. Nitrogen gas requirement can be met from open market of the near-by area only during peace time. However, during war scenario, there won't be any open market at war zone, so, if the tank moves inside the enemy territory, it would be impossible to locate the source for the gas at hand."

7. The Committee wanted to know whether DGMF had placed any order on CVRDE for procuring bulk quantity of the gas plant to meet it's requirement during strategic operations/war scenario and whether the Government had accorded approval to DGMF

for its units to hold a vehicle mounted gas plant. The Chairman, DRDO, while deposing before the Committee stated:

> "Hon. Chairman, the DGMF is known to using the existing T-90 and T-72 tanks which do not have hydro pneumatic type of suspension which is the latest. Even today and in the future, this type of suspension is expected to be used. Spring based suspension used in T-90 and T-72 cannot give the crew comfort. Therefore, the Arjun suspension is nitrogen filled. Having got the newer suspension, they were not totally aware at that point of time when we launched that it requires nitrogen gas which is needed to be replenished as and when it is required. It is true that we can have it in a bottle but in a war scenario, it may not be possible to mobilize wherever the tank goes. It has to be close to a group of tanks. That is the intent with which we did it. In all these designs, user will not come and tell us what exactly is needed, are to be decided by us, designed by us and provided by us. We did only one gas plant which was enough for the entire regiments. So always whenever the DRDO funding is given, the first piece is made and for that neither we get any order from the DGMF nor any money from them because they are not having any advance knowledge of our system. If they have not asked, because they may not even be aware of it. But subsequently, when they came for the training, after the decision given by the Steering Committee through DGMF they have agreed. All the aspects were looked into and all the user has agreed. I believe the minutes of the Committee also stated that it is a requirement. It is being used now by Army. As regards placing an order, for DRDO funding, they do not place any order for the first piece but when it is needed in a large quantity, they go to the production agency and place an indent. As regards ground based or a permanently fixed installation to a mobile installation, our thinking is that mobile installation is needed because we do not know where two regiments are going to exploit the tank. During war tanks may go to various places. At that time, we will be told that it is not moving sometimes, Army is going to a far away place from town and they can fill up the bottle like any other gas but during war time, coming and going may not be a viable solution. That is the reason, we provided one unit of this mobile generation station. As we said, 40 bottles are there and each bottle can completely fill up the two suspensions. So, one is more than enough for many of the tanks. Initially, we were not totally clear about the deployment pattern, so we talked to Army and they gave id and also it is needed in the emergency gas should be produceable in the war zone. It was an oral statement. Always this type of statement finally getting into a specifications sometime we need to make a prototype to get the approval. Today, an approval is there. The steering Committee has given the approval and the unit is being used by Army."

8. The Committee further found that in November 2011, CVRDE placed an order on M/s GEM Pressure Systems for supply of vehicle mounted mobile Gas Plant at a cost of Rs. 97.33 lakh and was taken on charge in August 2012. However, in September 2015,

it was noticed that even after a lapse of three years, the Gas Plant was held in CVRDE and thus, not being used for the intended purpose in the field areas/operations.

9. Replying to Audit's contention on the above, DRDO, in their Action Taken Note, submitted as under:

> "…only one plant was proposed to be developed as an experimental vehicle to ascertain the feasibility of its use. Further to the Order, CVRDE received the Mobile nitrogen plant during August 2012. After subjecting, the unit for performance evaluation and consistency in generation of nitrogen, the final 10% payment was cleared on 17.03.2014 on satisfactory functioning of the plant. Since the receipt of the plant, the Nitrogen gas was being regularly generated using the plant, as a part of its performance evaluation, in CVRDE and the gas being used for support of various activities of CVRDE for development of Arjun MBT Mk-II, maintenance & support of MK-I tanks held at CVRDE, testing of suspension units and other sub-systems. Although this was an exploration & development exercise as stated in above mentioned EPC paper, CVRDE proposed to hand over the plant to Army, as the performance of the plant was found to be good and consistent in compliance to the decision of XIIth Steering Committee. Accordingly, CVRDE requested Army to designate the agency for the same, vide Letter No. CVRDE/ARJUN/PMA/47 dated 28th August, 2014. For which, DG MF agreed and confirmed that the Nitrogen generator vehicle was to be taken over by 140 Armd Bde [246 Armd Workshop], vide Letter No. A/36026/MBTGen/GS/IP(AC) dt. 3rd September, 2014. Further, it may be noted that the plant is a combination of different sub-systems namely-Nitrogen generation unit, diesel operated generator, air compressor, high pressure booster, high pressure gas cylinders, storage fitment, etc., which requires proper training and understanding of the functioning of the system to the operating members. For which, to the CVRDE initiation vide Letter No CVRDE/ARJUN/PMA/47 dt. 8th December, 2014, Army nominated their personnel from 246 Armd Workshop vide Letter No. 70301/MBT/Wksp dt. 23 Dec., 2014 and got trained. In this process, the training has also been imparted to EME and Armoured workshop besides CVRDE members and also its regular usage at CVRDE. In the mean time, CVRDE has already taken up the initiative and got the BA No. for the vehicle on 14.9.2015 [vide Army DGIS No. B/28262/GS/MISO/TMS/BA No. dated 2nd Sept. 2015 and DRDO HQrs Letter No. DHRD/92481/CVRDE/BA/C/M/02 dated 14th Sept 2015], as the BA No. was necessary for forwarding the vehicle to field area. After completing all the subsequent formalities, the Army crew from 246 Armoured Workshop visited CVRDE and collected the vehicle vide Issue Voucher No. IV/EXT/MM/B-up RG/Loan/03 dated 29th April 2016. As of now, the vehicle has already reached 246 Armd Workshop [140 Armd Brigade], Jaisalmer, Rajasthan, and being utilized for further experimentation and exploitation in the field area. The 246 Armd Wksp confirmed that the Army received the plant and it is in serviceable

condition as on date. Further, it is stated hereby that the plant was under continuous usage for the above purposes as long as it was in CVRDE."

10. The Committee found that DRDO stated that being a research and development organization, CVRDE was required to visualize and develop state of the art system that would be advantageous in use of Armoured Fighting Vehicles. However, the procurement of the Gas Plant was not a developmental activity and the plant had already been developed by the same firm for DRDO in July 2010 and two such plants were supplied to Defence Research and Development Laboratory (DRDL) in January 2011. The Gas Plant was also demonstrated to the CVRDE scientists who visited the Firm's premises in July 2011 before placing of the supply order by CVRDE in November 2011. The integration, installation and assembly of components were well positioned as the Gas Plant was already developed for DRDO to meet the strategic requirement of the users and it was to be mounted on a vehicle.

11. DRDO, while clarifying their stand on the issue above submitted through written note as under:

"It was felt that there would be a need for strategic support vehicle, which shall be incorporated with all the self sufficient sub-systems for the generation of nitrogen gas from the atmosphere, and also on a military class chassis, so as to have comparable mobility to move along with the Army during the war. With this objective in mind, an experimental vehicle was developed and demonstrated after due lab scale evaluation. While there were issues with the initial acceptance by the Army after experimentation, exploitation and utilisation at CVRDE, the vehicle was handed over to Army 246 Armoured Workshop, 140 Armoured Brigade, during the year 2016, after giving adequate training to the Army personnel and completing all the purchase formalities & acceptance of the vehicle. Vide Letter No. 70301/MBT/Inst/Wksp dated 23rd Aug 2016, the 246 Armoured Workshop confirmed that the Army received the plant and it is in serviceable condition as on date. In addition to the above, the Armoured Workshop recently confirmed that the plant was in working condition and useful for the workshop vide Letter No. 70301/MBT Arjun/Wksp dt. 20 Feb 2017. Further, they have stated that the plant was being continually utilized for the generation of Nitrogen gas for the maintenance & upkeeping of Arjun MBT fleet."

12. In this regard, DRDO further informed the Committee as under:

"the same firm had already developed the plant for DRDO in July 2010, it is clarified that the Nitrogen plant ordered by DRDL & CVRDE were different. The nitrogen plant developed for DRDL was for the Lab [in-house] usage on a Static

> Platform, with bare minimum support system air dryer, nitrogen generator, receiver and booster system, with maximum pressure of 150 bar to charge the commercial/industrial gas cylinders with working pressure of 150 bar. Whereas, the mobile nitrogen plant conceptualized and developed for CVRDE is different from the above plant. The latter plant was developed on military class - Ashok Leyland Stallion Chassis for the first time to meet matching mobility requirements of the Armoured Regiments of the Army. In addition, the entire plant was visualized for self sustaining angle and provided with Diesel operated power generator and air compressor, so as to perform its function of nitrogen gas generation independently. The high pressure operating conditions necessitates fully integrated high pressure piping and handling of 300 bars, including their inherent safety aspects."

13. The Committee were concerted to learn that when enquired about the possible induction of the Gas Plant into service as a strategic maintenance vehicle for Armoured regiments, the Director General Mechanised Forces (DGMF), in December 2013 stated that their directorate was not pursuing any plan for acquisition of Gas Plant. It was further stated that the procurement of Gas Plant was an internal decision of CVRDE and Army had not given its concurrence or requisition for procurement of the Gas Plant. DGMF also stated that Nitrogen gas cylinders were authorised to Armoured Regiments for maintenance of MBT Arjun and the requirement for refilling of the cylinders wa carried out through the Ordnance factories channel.

14. It was also informed to the Committee that the DG MF (Army) was the ultimate user of the Gas Plant as the procurement of the Gas Plant was to meet Army's use during strategic operation/war scenario. the Committee sought to know why the Army's requirement of the Gas Plant was not ascertained before procuring the same. In their written submissions to the Committee, DRDO submitted as under:

> "The mobile nitrogen gas plant was developed/procured as support vehicle for MBT Arjun Main Battle Tank [Arjun MBT] as Technology Demonstrator by DRDO for maintenance & sustenance of MBT. It is the responsibility of DRDO to visualise & develop the defence system(s)/equipment(s)/support vehicles, which would provide advantageous features of maintenance of Arjun MBT during field operation and considering certain real time war scenario. The Mobile Nitrogen Generation Plant was housed on a military class vehicle [In-service Ashok Leyland Stallion Chassis] to have matching mobility with MBT. The entire gas plant was visualized for self sustaining angle and provided with Diesel operated power generator, so as to perform its function of nitrogen gas generation independently in remote areas of the operations. Further, 40 Nos. of high

pressure gas bottles/cylinders with working pressure of 300 bar were provided, exclusively to meet the charging pressure requirement of 14 Nos of Hydro-gas Suspension Unit [HSU] of each Arjun MBT in order to keep up the mission critical mobility conditions. Nitrogen gas is required for mobility of tank i.e. for the functioning of braking system under dynamic condition and to keep Gunner's main sight moisture free. These are the state of the art features which are latest in the World are not being used in the other Tanks currently held in the inventory of the Army. An attempt was made to develop altogether new support vehicle with tailor-made specifications considering the maintainability requirements of Arjun MBT. As this was an exploratory exercise, the experimental vehicle was done by DRDO independently as a Technology Demonstrator. However, on successful completion, the case was reviewed in XIth Steering Committee under the Chairmanship of Secretary [DP] and decided that DRDO was to transfer the N2 generation vehicle to Army for maintenance of the tanks. CVRDE proposed to hand over the plant to Army for further evaluation, as the performance of the plant was found to be good and consistent in compliance to the decision of XIth Steering Committee. Accordingly, DG MF agreed and confirmed that the Nitrogen generator vehicle was to be taken over by 140 Armd Bde [246 Armd Workshop], vide Letter No. A/36026/MBT Gen/GS/IP(AC) dt. 3rd Sept., 2014. After completing initial experimentation, exploitation and training of Army personal at CVRDE, the vehicle was dispatched to Army 246 Armoured Workshop, 140 Armd Brigade, during the year 2016."

15. The Committee sought to know the reasons for procurement as Army had categorically stated that they did not require any Nitrogen Gas Generator Plant as their requirement of gas was met through the Ordnance channel through procurement. In this connection, DRDO clarified as under:

"Although the Army stated earlier that the gas requirement was met through the Ordnance channel through procurement from open market before the issue of the plant, the importance of requirements of the Nitrogen gas in order to keep the Arjun MBT in war-fit condition, the need for the plant and the issues related to sourcing through the open market under ordnance channel. It may kindly be noted that the Hydro-gas Suspension Unit [HSU] is provided in Arjun MBT, as leg & foot for the tank to support its static load and as well as provide cushioning effect under dynamic conditions. Total 14 HSU stations are provided in each Arjun MBT. This HSU system works on with the two important working medium viz. SAE 10W30 Oil and Nitrogen Gas. Under the working conditions, any load or undulation due to road/terrain/off-road interactions of the vehicle is getting transferred through Track, Roadwheel, Axle arm & other mechanical linkages to the oil inside the HSU actuator cylinder, which in-turn through damper & accumulator cylinder/piston arrangement to the nitrogen gas, which acts as gas spring under pressurised condition for the reactive force. As such, the Load bearing capability of the Hydro-gas suspension Unit [HSU] of Arjun MBT Mk-I directly depends on the nitrogen gas pressure in the accumulator cylinder of the

HSU, which is generally maintained at around 180 bar in static condition of the tank. Under the circumstances, leakages of the gas, if any, would lead to the immobile condition for the tank. Further, the charging of the gas is an important procedure to be followed for the replacement of HSU during repair/maintenance. In addition to the above, the nitrogen gas purging is also done in Brake accumulator of hydraulic - brake control of automatic transmission system. Any loss or unavailability of the nitrogen gas in the system would lead to complete failure of brake system of the vehicle. Further, the nitrogen gas is also required to be charged in the Gunner Main Sight [GMS] chamber, in order to keep it free from moisture/water particles, so as to have good visibility and accuracy during the firing."

16. DRDO through their written replies further informed the Committee as under:

"Nitrogen gas is very important for up-keeping of the tank, as its unavailability will affect both the mobility and firing capabilities, which are all mission critical features of the tank. At the same time, CVRDE would like to re-iterate again that the nitrogen gas requirement can be met from open market of the near-by area during the peace time, as being done now through ordinance channel. Further, in the DGMF Letter No. A-36026/MBTGen/GS/IP (AC) dated 17.12.2013 addressed to the Dy. Director of Audit, it was mentioned that the Ordnance Depot receives its supplies of Nitrogen gas from Jodhpur Gas Agency, Industrial Area Boranada, Jodhpur. However, during war scenario, there won't be any open market at war zone. If the tank moves inside the enemy territory, it would be impossible to locate the source for the gas at those places. Under the circumstances, it was felt that there would be a need for strategic support vehicle, which shall be incorporated with all the self sufficient sub-systems for the generation of nitrogen gas from the atmosphere, and also on a military class chassis, so as to have comparable/matching mobility to move along with the Army during the war. With this objective, in mind, an experimental vehicle was developed and demonstrated after due lab scale evaluation. As this development exercise has been done for the strategic application and found to be acceptable, the vehicle has already been to the Army after completing all the formalities.

17. With the Army showing no interest in the Nitrogen Gas Generation Plant developed by CVRDE, the Committee sought to know whether the developmental activity, undertaken on experimental basis, proved wasteful. Clarifying its position, DRDO informed as under:

"CVRDE proposed to hand over the plant to Army, as the performance of the plant was found to be good and consistent in compliance to the decision of XIIth Steering Committee, after a due deliberation with the user. Subsequently, Army has already designated its agency [140Armd Bde - 246 Armd Workshop], got trained their personnel and collected the vehicle. As of now, the vehicle is being utilised by the 246 Armd Workshop [140 Armd Brigade] in the field area. It is

understood from the recently visited CVRDE team to the field area that the plant is under continuous usage and utilisation by the Army Unit - 246 Armd Workshop, which provides comprehensive engineering & maintenance support to the two Arjun MBT Regiments [43 & 75 Armoured Regiments] of the Army. Further, it is reiterated hereby that the plant was under continuous usage earlier for the above purposes as long as it was in CVRDE. Therefore, the development/procurement done through open tender basis was not wasteful."

Para 6.2 Infructuous Procurement of Material

18. A Technology Demonstration Project was sanctioned by Defence Research and Development Organisation (DRDO) in March 2001 for 'Design and Development of Hypersonic Technology Demonstrator Vehicle' (HSTDV) by Defence Research and Development Laboratory (DRDL). DRDL undertook a feasibility study in September 2003, which included a study on design and development of scramjet engine. The study found that the temperature encountered in the scramjet engine combustor was of the range equivalent to 2227-2527^{o}C. DRDL therefore identified two high temperature resistant materials *viz* Nimonic C-263 and Niobium C-103, for possible use in the development of the engine. DRDL found that C-263 was the suitable material which could sustain for 20 seconds flight duration. The maximum temperature resistance capability for C-103 material was found to be 1200^{o}C, which could be enhanced only up to 1370^{o}C through coating technique.

19. Taking note of the background of the subject, the Committee also found that in September 2005, Ministry of Defence sanctioned a project for 'Development of Scramjet Engine and Engine Integrated Airframe' at an estimated cost of Rs. 48.65 crore as part of the HSTDV project, to be taken up by DRDL, Hyderabad. The aim of the project was to design, fabricate and carryout testing of scramjet engine. Scramjet engine is subjected to very high temperature. DRDL identified C-103 material as High Temperature Resistant Material (HTRM) for inner layer of the engine and C-263 for the outer layer. Requirement of C-103 material, which has a shelf life of 10 years, was accordingly projected for development of five scramjet engines. However, keeping in view the anticipated design changes and high cost involved, the Special Purchase Committee (SPC) held in May 2006 recommended procurement of C-103 material for development of only three scramjet engines. In July 2007, DRDL accordingly procured a

quantity of 1329 Kg of HTRM worth Rs. 4.83 crore which was received between October 2007 and October 2008. A quantity of 3660 Kg of C-263 material was also procured between December 2007 and February 2008 at a cost of Rs. 1.76 crore, for use in the project.

20. Throwing light on the above observation, in their Background Note, furnished to the Committee, DRDO stated as under:

> "C-103 material procured was intended to be used for fabrication of single module-double wall Scramjet engine. The material was procured after the recommendations of two experts committee under the Chairmanship of Dr. AR Acharya, Group Director, VSSC and Dr. Baldev Raj, Director, IGCAR, Kalpakkam during scramjet engine design and fabrication reviews. The committees had cleared the design and fabrication methodology using C-103 materials. C-103 is a strategic material being widely used in the international scenario for high temperature and high speed engine development programmes for which the lead time in procurement is high. Hence, conscious decision was taken to procure C-103 material."

21. It was observed in March 2012 that the feasibility study carried out in 2003 had specifically brought out that C-103 material can resist temperature only up to 1370^0C whereas the temperature generated in the scramjet engine combustor would range up to 2527^0C. Despite this known limitations, DRDL procured 1329 Kg of C-103 material. During the process of development, DRDL used only 107 Kg of the C-103 material and found that it could not withstand the high temperature beyond five seconds and therefore, the balance material was not further used. When enquired about the justification for procurement of the material, DRDO HQ stated that due to severe oxidation problem/change in engine combustor design, C-103 material could not be used and C-263 material alone has been used for the scramjet engine development. although usage of C-103 material has limitation as the temperature experienced is more than 2300^oC, yet considering the ground test data it was expected that the same had potential for longer duration tests of the order of 100 seconds and 200 seconds with suitable anti-oxidation coating techniques.

22. The Committee wanted to know whether procurement of material was unwarranted and which eventually proved wasteful expenditure. In this regard, the Director-DRDL during evidence stated as under:

"The temperature in the engine is of the order of 2,500 degrees because the hot flame is actually coming out of the engine. But even though the gas temperature is 2,500 degrees, the metal temperature will be around 1,000 degrees for the 20 second duration. It takes time for the metal to heat up. So, it is still not a wrong decision to select this material. Even now the temperature predicted will be 1,000 degrees and this material will withstand. But after procuring the material, when we attempted to use this material for fabrication, we got into a number of fabrication issues. The original design was to have an external structural layer of C-263 with C-103 inside which is exposed to the heat. The combination of these two materials have faced some welding problem. This has never been done earlier. This material has to be given silicide coating without which the properties were going to drop. This coating application process was not readily available for this configuration"

23. He also stated:

"Sir, I still say that 2,500 degrees is the gas temperature. Maybe our people were unable to clarify the technical point to the Audit. The gas temperature is 2,500 degrees, but the material which is holding that gas is not crossing 1,000 or 1,100 degree centigrade. So this material is still valid and even in the world nowhere there is a material which can withstand this kind of 2,500 degree centigrade temperature."

24. The Committee did note that DRDL was aware that C-103 material had limitations to resist high temperature encountered in the scramjet engine combustor. Yet, it procured the C-103 material, which eventually proved wasteful. Besides, the Project proposal envisaged flight tests of short duration of 20 seconds, for which the material has failed, hence the possible usage of C-103 material for a longer duration flight tests of 100 seconds and 200 seconds was unlikely.

25. On the point that C-103 material had failed flight tests of 20 seconds short duration and the subsequent decision to use the material for longer duration flight tests of 100 seconds and 200 seconds, Director-DRDL, during oral evidence, submitted as under:

"In May, 2006 only design was completed at that stage. The first time this material came to our country under this procurement was in 2008. There was no material existing with us. This was the first procurement. It was never procured earlier to this. For longer duration, you have to go for new technology."

26. Supplementing the above, Scientific Advisor to the Prime Minister, during evidence stated:

> "We procured the material for three engines only. We procured the material required for only three engines, not more than that. What we are trying to do is, we make one proto type, one qualification unit and one flight unit."

27. Taking note of the fact that the design was not finalized and tested and the feasibility study revealed that C-263 was the suitable material, the necessity of procuring huge quantity of C-103 material worth Rs. 4.83 crore was questioned by the Committee. In this connection, DRDO through written reply, intimated as under:

> "Initially, the preliminary design of Scramjet engine was carried out considering two approaches – Single Wall & Double Wall type construction. For achieving the required design with single wall type construction resulted into heavy weight penalty. Hence, double wall type construction was considered and it was found that double wall construction for weight optimum design with stringent constraints of deflection and allowable stress is a feasible solution (Report no.DRDL/DOFS/ASD/HSTDV-01/18 dated 13th July 2004). Subsequently, a single module double wall configuration of size 550 mm width X 250 mm height X 2885 mm length with C-103 Niobium based alloy and C-263 Nimonic alloy as outer wall was analysed and design finalised. Among all refractory materials, Niobium alloys (C-103 is one of the Niobium alloys) were found to be ductile, lighter weight, possessing good fabricability. C-103 material for the combustor chamber of the scramjet engine is a reliable material for high temperature application."

28. DRDO, also through written reply further furnished as under:

> "Small quantities of C-103 material of thickness 1.7mm (15kg) available ex-stock at M/s MIDHANI and 3mm thickness (2.34kg) available with M/s GCL chemicals, Coimbatore was procured in Oct, 2004. This small quantity of material was used for evaluation trials at coupon level and data generation for design. Detailed Design and thermo-structural analysis of double wall Scramjet engine was carried out by Structures Group (DOFS), DRDL and independently verified by Design Experts at IGCAR, Kalpakkam in October 2007. A committee was formed in 2007 to review Thermo-structural design of Scramjet Engine with leading experts from various organisations under the Chairmanship of Dr. AR Acharya, well known structural expert from ISRO. This committee reviewed and cleared the design of double walled construction of Scramjet Engine using C-103 & C-263 materials for further fabrication."

29. DRDO further submitted in a post-evidence reply that:

> "manufacturing process was also studied in parallel at DRDL and finalised process has been presented and discussed with the scientists of various expert organizations across the country in the field like IGCAR-Kalpakkam, VSSC-Thiruvananthapuram, LPSC-Bangalore, LPSC-Thiruvananthapuram, NFTDC, Hyderabad, IUAC-Delhi, GTRE-Bangalore, MIDHANI-Hyderabad etc. and input from them has been used in this Engine development. A committee was formed in 2007 to review and recommend the manufacturing methodology and suggested to start fabrication of engine immediately after receiving the qualified material. The experts committee advised to look into critical technological areas such as explosive bonding of Niobium base C-103 and Nimonic C-263 alloys, Electron Beam Welding, Laser Welding, large size vacuum heat treatment, anti-oxidation silicide coating, etc as these are being developed for the first time in the country for C-103 alloy."

30. DRDO, while explaining the merit behind the procurement of the material, through written reply stated as under:

> "C-103 is a strategic material being widely used in the international scenario for high temperature Scramjet engine development programmes for which the lead time in procurement is high. Hence, concise decision was taken to procure C-103 material. C-103 material was procured by Oct 2008 for 3 sets of Scramjet Engine development. Welding trials such as TIG welding, Electron Beam Welding were carried out. As these two materials are dissimilar it resulted in the formation of brittle intermetallic compounds in the weld joints. Hence, this scheme did not meet the requirement. As an alternate approach, the diffusion and explosive bonding were carried out to bond C-103 & C-263. Out of this, explosive bonding was found to be suitable at coupon level. Several complexities were encountered to manufacture full scale Scramjet engine because of large shape and size (rectangular cross section, length 2.8m, width 550mm), joining complexities, requirement of large size vacuum heat treatment facility, inadequate manufacturing facilities. Hence, fabrication of full scale engine using C-103 and C-263 was found to be complex and difficult. At this juncture, complexities in fabrication & coating issues for development of Scramjet engine using C-103 & C-263 were being addressed. In the meantime, an alternate approach was considered by introducing middle wall thereby modifying the existing double walled single module design to two module-single wall construction using C-263 alone."

31. DRDO also through post-evidence reply submitted that:

> "Mid-course technical design changes are very much a part of design and development process. This modified design has reduced the stresses and deflections as the width of engine is reduced from 550mm to less than 225mm. The two module engine configuration using C-263 also meets the design

> requirements, in spite of C-263 being inferior to C-103 in terms of thermal properties. It may be noted that C-263 has been considered for limited short duration of 20 seconds for present HSTDV mission, however for long duration flight (about 600 sec), C-103 along with regenerative cooling will be a better option. For present HSTDV mission, based on this modified design, the Scramjet engine has been fabricated using C-263 alone and more than 60 ground tests have been conducted successfully. The flight worthy Scramjet engine has been realized (weight=330kg) and thermo-structurally qualified. Hence, C-103 material could not be utilised for the fabrication of Scramjet engine for the present HSTDV programme. However, it has been gainfully utilised for establishing technologies such as explosive bonding, Electron Beam welding, Laser Beam Welding and Oxidation resistant coating trials as a part of HSTDV demonstration project to develop advance technologies for future programmes. The technologies using C-103 material for the development of Scramjet engine have been successfully established and can be used for long duration Scramjet engine development."

32. During oral evidence, the Committee sought to know if the material was found suitable then why it was not used for its intended purposes. The Director-DRDL in this regard submitted as under:

> "It was because when we saw there were manufacturing limitations such as in the form of welding or dissimilar material, that was taking time. Then, we had to develop the laser welding technique. Then, silicide coating development was taking time. Then, an alternate design was developed with two modules. Originally it was designed with a single module and later on it was made into two module engine. Once you design with a two module engine, the stresses had come down. Even C-263 was meeting the requirement. So we went ahead with that. The objective was to make the engine. A simpler material C-263 was meeting the requirement for short duration with the configuration design change."

33. The Committee took note of the fact that as per feasibility study of Hypersonic Technology Demonstrator Vehicle (HSTDV), the long duration flight tests would require materials with superior high temperature capability, good thermal stability and high oxidation resistance. It was seen that 146 Kg of C-103 material was transferred to DMRL, Hyderabad for development of oxidation resistant coating. They wanted to know whether oxidation resistant coating was developed and tested with C-103 material for its sustainability to high temperature in long duration flight tests. DRDO replying to the Committee's queries through written reply intimated as under:

> "…the oxidation resistance coating technology has been developed and tested with C-103 material for its sustainability to high temperature in long duration flight tests at DMRL. DMRL has carried out extensive testing using C-103 material

supplied by DRDL and developed oxidation resistance coating using slurry deposition method and Pack carburising methods. The oxidation resistant silicide coating using slurry deposition method has been developed with C-103 material and the same can be adopted to high temperature in long duration flight tests (of about 600 sec)."

34. The Committee desired to know whether long duration project had been sanctioned and whether C-103 material had been found suitable at high temperature for long duration flight tests. In response, DRDO through post-evidence reply, DRDO submitted:

"…presently HSTDV mission for 20 sec duration was being pursued and flight test scheduled before the end of this year. However, feasibility studies for Long duration hypersonic flight were being carried out at DRDL in parallel. The proposals had been discussed during the apex board meetings and the project proposal would be submitted after finalisation of mission and configuration. From the design and experimental studies, it is found that C-103 material is suitable for long duration mission with regenerative cooling for scramjet engine application."

35. The Committee learnt that out of 1329 Kg of HTRM received, 616 Kg valuing Rs. 2.25 crore was held as of August 2015. The Committee sought to know whether this quantity had been gainfully utilised and for what purpose. DRDO in response, through written reply, informed as under:

"DOAMP, DRDL had established welding methodology for dissimilar materials by conducting various experimental trials and establishing the welding characteristics of C-103 alloy for EB Welding, Laser Welding etc. including the post weld heat treatment procedures in vacuum atmosphere and surface engineering treatments. Propulsion group (DOLP) of DRDL was involved in the development of different types of long duration thrusters (burn time 100 seconds) for programmes of Missile Complex. DOLP, DRDL had established the fabrication process and methodology for fabrication of thrusters components using C-103. Out of 616 kg, 247.25 kg had been gainfully utilised and out of the balance material of 368.75 kg, 208.75 kg was already under consumption at various stages of manufacturing/testing of thrusters components. The balance material of 160 kg was available at DRDL which was planned to be utilised for development of Scramjet engine for long duration Hypersonic mission."

36. During oral evidence, Director-DRDL, supplementing the above, stated:

"Sir, over the last four years, we used this material to establish the various manufacturing technologies. Now, we have established the Welding Technologies; we have established the Coating Technologies. We feel, now, that this material is suitable for long duration engines in future work. In the

meantime, we also had a requirement to use this material for another project-Ballistic Missile Programme, where we have successfully, with this material, tested it for 125 seconds. So, whatever material has been procured, as of now, around 88 per cent of it has been used in various R&D activities to develop the technologies required for the future and also for some products for the Ballistic Missile Programme. In our various Groups, it is done."

37. Supplementing the above, Chairman-DRDO, during oral evidence, also stated:

"The remaining per cent is also being utilized. It is already in the pipeline in various activities. We will submit the report showing the utilization of the material."

38. The Committee were of the view that procurement of C-103 material valuing Rs. 4.83 crore for development of scramjet project was unwarranted and proved wasteful and wanted to know whether any responsibility had been fixed in this regard. DRDO replying to the Committee's concern, through written reply furnished as under:

"…the Scramjet technology programme was one of the most ambitious programme of advanced countries like USA, Russia, China, France, Australia and Japan. Worldwide it is a closely guarded technology and the detailed information including fabrication technology with C-103 material is not available in the open literature. C-103 is one of the most suitable and reliable materials for the combustor chamber of the scramjet engine for high temperature application. Two experts committees under the Chairmanship of leading experts from ISRO and DAE had cleared the scramjet engine design and fabrication methodology using C-103 materials. C-103 is a strategic material and the lead time in procurement is high and decision was taken to procure the material considering tight project schedule. The procured material had been gainfully utilised to develop related technologies like Explosive bonding, Electron beam/Laser welding, various methods of Anti-oxidation coating applications and established for future development of re-generatively cooled scramjet engine. This material was partially being utilised by DMRL for development of materials and related technologies for future long duration hypersonic flights under Hypermat Project and by Propulsion group of DRDL for development of long duration (> 100 sec) thrusters. It was planned to utilise the remaining material for radiation cooled rocket thrusters and long duration hypersonic vehicle. The procurement of material in DRDO as a policy was examined and approved both from the necessity and expenditure angle with financial concurrence at appropriate levels by the various committees. After approval, the procurement action was initiated by the project comprising of a team of technical experts, but not by the decision of any individual. Hence, the procurement had not been wasteful and responsibility had not been fixed."

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PART-II

OBSERVATIONS AND RECOMMENDATIONS

Para 6.1 Avoidable Procurement of a Mobile Nitrogen Gas Generator Plant

1. In their examination of Para 6.1 on "Avoidable Procurement of a Mobile Nitrogen Gas Generator Plant" based on the C&AG's Report No. 19 of 2016, the Committee find that Combat Vehicles Research & Development Establishment (CVRDE), placed an order for development of a mobile Gas Plant, at a cost of ₹ 97.33 lakh despite no demand from the Army for Nitrogen gas generator plant. In Committee's view, the development of Gas Plant by CVRDE was unwarranted as the plant had already been developed by the firm, M/s GEM Pressure Systems for DRDO in July 2010 and supplied to Defence Research and Development Laboratory (DRDL) in January 2011. However, the gas plant was not used for intended purposes in the field areas/operations for three years.

2. The Committee note that nitrogen gas is very important and critical to keep the Arjun MBT in war-fit condition as it is necessary for achieving cushioning effect of the hydro-gas suspension unit, for the functioning of the braking system under dynamic condition and to keep the Gunners Main Sight moisture free. They further note that during war, a strategic support vehicle would be needed which shall be incorporated with all the self sufficient sub-systems for the generation of nitrogen gas from the atmosphere on a military class chassis, so as to have comparable mobility to move along with the Army. However, the Committee are dismayed to note that the acquired gas plant from M/s GEM Pressure Systems remained unused for three years as it was steadily being used by DRDL for performance evaluation and consistency in nitrogen generation plant despite being procured for the end user i.e. the Army. Also, Army had initially stated that they did not require the gas plant as their nitrogen gas cylinders were being refilled through the Ordnance factories and were reluctant to receive the procured gas plant as they were self sufficient with the available resources.

In this regard, the Committee observe that DRDL is the nodal agency to provide for the specific needs of the armoured brigades of the Army and were mandated to develop the nitrogen gas system for Arjun MBT but due to developmental exigencies, the gas plant was procured from a private vendor terming it as a R&D project. They also note with concern that acceptance of the gas plant by the Army for trials appeared to be under

duress as the Director General Mechanised Forces (DGMF) had stated that CVRDE had offered them the gas plant on 'no cost and no liability to the Army'.

Also, the Army has not placed any bulk orders for the gas plant indicating that the development of gas plant by CVRDE has overshot the time frame of developmental window and the end user is dependent on private manufactures for the gas plant. The Committee are of the view that since CVRDE is mandated for developing and providing critical hardware for the armoured wing of the Army, nevertheless they are lagging behind in this area. They find that the establishment did not take the end user on board and to supply them for their tailor made requirements. The Committee, therefore, desire that all the stakeholders should have a consensus for the creation of such important hardware as it has a direct bearing on the work horse of the armoured regiments i.e. Arjun MBT which is essential in war time scenario. They therefore recommend that the Army should lay down their explicit requirements in future to establish a proper chain right from the conception stage to manufacturing of the end product and subsequently handing it over to the Army for trials and eventual use.

3. In this particular case, the Committee would like to bring to light the fact that the Army, specifically the DGMF does not effectively require the gas plant for its regular maintenance or operational requirements as they have established their supply chain through the Ordnance factories. They wonder as to why DRDO/DRDL did not develop or augment the existing facilities at Ordnance factories for development of the gas plant due to its mission criticality in times of war. The Committee are not oblivious of the fact that development of military technologies and their incorporation in hardware is a time consuming process but wonder if a private firm could develop the gas plant, why it took DRDO/DRDL five years in developing the same and reaching finality. They accordingly recommend that DRDO should furnish details about the development and subsequent production of the gas plant to the Committee.

4. Consequent to enquiring this subject, the Committee in general infer the need to re-look in to the functioning of DRDO and its associate laboratories as they are of the view that under confidentiality or secrecy, development of sensitive technologies has been a very time consuming affair. They are of the view that DRDO needs is operational freedom to function more effectively and deliver world class products on time. Also, the Committee are of the specific view that synchronization is not effective between the DRDO and the armed forces as they feel coordination among the agencies has affected

the systematic development of military hardware. The Committee desire the administrative Ministry i.e. the Ministry of Defence to play a proactive role in better synchronisation and coordination among the agencies as both are mutually interdependent on each other and their association has direct bearing on the overall security and preparedness of the Country. The Ministry may provide the Committee steps/measures proposed to be taken in this regard.

Para 6.2 Infructuous Procurement of Material

5. In regard to Para No 6.2 on "Infructuous Procurement of Material", the Committee observe that DRDL was aware of the fact that C-103 material had limitations to resist high temperature generated in the scramjet engine combustor and the material had also failed in the flight tests of short duration of 20 seconds, yet, 1329 kgs of C-103 material was procured valuing ₹ 4.83 crore, which eventually proved wasteful.

6. Scramjet or supersonic combustion ramjet is an air breathing jet engine in which high vehicle speed is used to compress the incoming air forcefully before combustion in supersonic airflow allowing it to operate efficiently at extremely high speeds thus generating very high temperatures in the range of 2227^0C to 2527^0C. Committee's scrutiny of the subject reveal that for the development of scramjet engines, DRDO procured Nimonic C-263 and Niobium C-103 materials for their high temperature resistance properties. However, the Committee note with concern that both the materials eventually failed in the testing phase and some quantities of the materials were used in other on going research projects, thus defeating the very purpose for which these were originally procured for. They would like to highlight the fact that DRDO contested C&AG's claim of unwarranted procurement and eventual wastage by stating during their audit, the DRDO scientists could not properly explain the logic behind the move. However, the Committee are of the opinion that in the field of research and development, conclusions are reached by the way of experiments applying trial and error method but are of the considered opinion that materials procured should be used for their intended purpose and not to be used for other ongoing projects. Since development of new hardware is a technological intensive activity, the Committee recommend that DRDO and its associated laboratories may draw a comprehensive roadmap by undertaking thorough due dilligence for the development right from the conception stage till the manufacturing stage so that delays are minimised. The action initiatied/taken in this regard should be intimated to the Committee.

7. Coming to inquiry of this subject, the Committee observe that C-103 material could resist only 1370^{0}C whereas the heat generated in the scramjet engine reached upto 2527^{0}C. However, DRDO stated that the high temperature generated was the gas temperature. The Committee take serious note of this discrepancy and recommend that DRDO may furnish the specific reasons for procuring the material out of which only 107 kg of C-103 was used and remaining 88 per cent of the materials was used in ballistic missile programme and other R&D programmes. Having been apprised of the alternate usage to which C-103 can be put to use, the Committee recommend that procurement for such alternate projects should be made project specific and that possible alternate utility could not be used to justify procurement of unsuitable material. They further desire to be apprised about the present status of the project with complete details to be forwarded to them for taking the issue to a logical conclusion.

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Part - B

"DEVELOPMENT OF AN INTEGRATED AEROSTAT SURVEILLANCE SYSTEM" AND "IRREGULAR SANCTION AND EXPENDITURE OF ₹ 5.20 CRORE ON CONSTRUCTION OF VEHICLE TESTING GROUND AFTER COMPLETION OF THE PROJECT" based on Para Nos. 6.1 and 6.2 of Chapter VI of the C&AG's Report No. 15 of 2017

REPORT
PART - I

I. INTRODUCTORY

1. The Committee selected Chapter VI of the C&AG's Report No.15 of 2017 relating to Defence Research and Development Organisation (DRDO) for detailed examination and report. This Chapter contains two paragraphs out of which Para 6.1 relates to 'Development of an Integrated Aerostat Surveillance System' while Para 6.2 relates to 'Irregular Sanction and Expenditure of ₹ 5.20 Crore On Construction of Vehicle Testing Ground After Completion of the Project'.

2. Against this backdrop, the Public Accounts Committee (2018-19) obtained background note and requisite replies and some other clarifications from the Ministry of Defence (MoD) and Defence Research and Development Organisation (DRDO). The Committee took oral evidence of the representatives of the MoD and DRDO on both the paras on 07.09.2018 and consequently obtained information on the subject. Based on the information gathered, the Committee proceeded with examination of the relevant issues in detail as outlined in the succeeding chapters.

Para No. 6.1: Development of an Integrated Aerostat Surveillance System

3. The Committee found that aerostat is a balloon based platform which is based on lighter than air principle and carries payloads for surveillance and communication purposes. The Aerial Delivery Research and Development Establishment (ADRDE), Agra, had completed in 2013 the development of medium size aerostat of capacity 2000 cum under a research and development (R&D) project named 'Akashdeep' by using polyurethane (PU) coated nylon fabric with payload capacity of 300 kg, endurance of five days and balloon life of 18 months.

4. The Committee also found that Indian Army expressed interest in the development of an aerostat platform with net payload capacity of 300 kg and an endurance of 7 to 14 days with balloon life of four to five years at a total cost of ₹ 48.80 crore by December 2014 using laminated fabric. It was provided for in the project proposal that in case of unavailability of laminated fabric, attempt would be made to

import the fabric. The project also included a sub-system for aerostat platform namely Communication Intelligence (COMINT) payload to be developed by Defence Electronic Research Laboratory (DLRL) at a cost of ₹ 22.50 crore. DRDO sanctioned a technology demonstration (TD) project, 'Nakshatra', to ADRDE in July 2011. The project cost was revised to ₹ 58.80 crore in October 2013 to cater for the import of laminated fabric and the probable date of completion (PDC) of the project was extended up to June 2016.

5. Giving background of the Project, the Chairman - DRDO, during oral evidence, stated as under:

> "....DRDO has a laboratory in Agra called ADRDE basically to develop the aerostat surveillance systems for the defence requirements. ADRDE had taken up a project for development of aerostat integrated system for surveillance and monitoring. The project is called Nakshatra. At that time in the country we had some technology available for polyurethane-based balloons and the laminated technology was not available. In the project Peer Review Committee and in the sanctioning process, it was said that we should make a polyurethane-based balloon and also try to make a laminated balloon which has a longer life. So, both polyurethane and laminated balloons started developing with the resources and people available in the country. When we started attempting on a small piece of laminated model, it was not successful. So, it was suggested again that we should go for one laminated-based balloon as a standby option for this. So, procurement action for the laminated one also started while the development of polyurethane-based balloon went on in the country."

6. The Committee wanted to know the specific reasons for escalating the project cost to ₹ 58.80 crore in October, 2013 from Rs. 48.80 crore as originally envisaged in July, 2011. They also wanted to know the specific reasons why the enhanced cost was not anticipated at the time of sanctioning of the project. In this connection, DRDO though a written reply, intimated as under:

> "At the time of sanctioning of project the total project cost was estimated to be ₹ 48.8 crore. One of the project objectives was to develop balloon with laminated fabric. In spite of all the scientific efforts put in by the Scientists at ADRDE, the required technologies for the realization of balloon with laminated fabric was not fully matured. Therefore, to meet the project objectives, it was proposed to procure a laminated fabric balloon with an additional estimated cost of ₹ 10.0 crore and after sanction, the revised cost of project escalated from ₹ 48.8 crore to ₹ 58.8 crore. However, the project is completed with total expenditure of ₹ 49.5 crore."

7. The Committee desired to know as to why the date of project completion was extended from December, 2014 to June, 2016. The Ministry in their written reply stated as under:

> "Following are the main reasons for completion date of project (PDC) extension from December, 2014 to June, 2016 -
>
> (a) As per initial project realization plan, COMINT payload was to be procured under "BUY" option and integrated with aerostat system for demonstration. But it was found that the available payload was not meeting the project requirements and therefore, need was felt to develop indigenous COMINT payload. Number of meetings and brain storming sessions were held between DRDO Scientists and all stake holders to arrive on technical particulars/specifications for realization of COMINT payload and related subsystems. These technical particulars was finalized and also endorsed by Users vide letter no 55340/ABC/NAKSHATRA/SI-11 dated 21 Jan'2014.
>
> (b) Scope of the project activities was extended to carry out Users associated technical trials of prototype system developed for technology demonstration and imparting training to Users representatives on system installation, integration, operation and maintenance.
>
> In view of above, to realize COMINT payload and related subsystems after finalization of endorsed QR and to complete extended scope of project activities, the completion date of project was extended from Dec, 2014 to Jun, 2016 and the project objective are successfully met."

8. Adding further on this point, the Chairman - DRDO, during oral evidence, stated as under:

> "The ADRDE has successfully developed the polyurethane-based balloon and started utilising it. It has successfully performed, and the tests continued with the same polyurethane-based system. It has been tested a number of times. The testing went on for six months. Meanwhile, the balloon procured in an open tender was received by the laboratory and was kept as a standby option to replace the first one in case it gives a problem on aspects like durability and life."

9. He further stated that:

> "However, the indigenously developed balloon has functioned well. It went through all the tests. During the process of testing, it called for an extension to test in detail and to improve the system. So, extension of the project was taken up in 2016 and it had gone through successful testing as per the parameters given in 2016. There was no opportunity to test the standby balloon that was procured and so it had been kept aside. Army was a part of this. Army has gone through the testing and they have seen the results. As the project went on for so

many years, army is now looking for a similar balloon but with improved specifications. They are making the specifications for a balloon with improved specifications. Sir, what I want to submit is that as parallel options of polyurethane and laminated fabric-based balloons were to be pursued, as the laminated-based balloon technology was not available in the country, to realise aerostat a balloon was procured and kept there. But good success has been achieved by the indigenous system and the indigenous system has performed well, and so the standby system could not be utilised. We are trying to make another airframe and trying to make the laminated-based balloon also to be utilised right now. This is the status. It was right in the beginning taken as option No.2 and the balloon was purchased to make the project successful. The primary system that we made has worked and so we could not utilise the standby option. Sir, I again submit to you that the laminated-based balloon was procured as that technology is not available in the country."

10. The Committee noticed through the reply of DRDO (in January 2017) that ADRDE spent ₹ 6.20 crore on import of balloon made of laminated fabric from a foreign firm. However, this balloon was not utilised in the project as the project was carried out using PU coated fabric balloon. This project had been closed by ADRDE on 30.06.2016 after incurring an expenditure of ₹ 49.50 crore without acceptance of the Army and had not been utilised for the intended purpose.

11. DRDO, in their Background Note, while explaining their position informed the Committee as under:

"In Nakshatra project proposal, 03 nos. of the balloons (01 for Test & evaluation , 01 for Demonstration and 03rd as a spare) were catered for, to meet the desired project objective. Helium filled Balloon is made up of flexible textile material and there is a risk of damage due to gust & storm. Therefore, standby balloon is always kept for such contingency due to long lead time for balloon procurement. To meet the requirement for standby balloon during trial as per project proposal, imported laminated fabric balloon was supplied by Indian Industry i.e. M/s Pipavav Shipyard Ltd, Rajula (Gujarat) and kept as standby for usage in case of any failure of indigenous Balloons during trials. However, during extensive flight trials/testing, no damage has occurred with PU coated indigenous balloon and project objectives were achieved. Hence, need to use standby balloon did not arise in the project. Since, the indigenous PU coated balloon could fulfill the project objectives, the laminated standby balloon was not required to be used. However, the same would be used for future trials. Also against two indigenous Balloons sanctioned in project, only 01 no. indigenous advanced Polyurethane (PU) coated fabric balloon was used during flight trials/testings and project objectives were met. Hence, the second Balloon was not procured. The project was undertaken on a Technology demonstration (TD) mode. All required

technologies have been established to meet project objectives during successful User Assisted Technical Trials (UATT) with COMINT payload. In the next stage, this equipment has to be proven as per requirement of the Army. Accordingly, requirements have been deliberated with Army & draft QR has been forwarded to them (as decided in meeting with Army) for approval in order to take up a new project which would include field trials by Army. Army is in process of finalizing the QR and case will be taken further after approval of QR by Army."

12. The Committee sought to know the reason behind the construction of aerostat with PU coated fabric in the first instance. The Ministry through a written note informed the Committee:

"The availability of laminated fabric was under “High Development Risk Area”. In case of its non-availability, the balloon was developed using PU coated fabric for integration and testing of COMINT payload as per project strategy. The same was also mentioned in the project proposal at the time of sanction of the project. Hence, first PU coated fabric balloon was developed to complete integration and initial testing of other subsystems till such time the laminated fabric balloon is realised."

13. The Committee sought to know as to why during the initial project stage, a provision was made for three balloons but the objective was met with only two and how was the third stand-by balloon put to use. In this regard, the Ministry submitted as under:

"Balloon is a flexible structure made of light weight fabric and susceptible to damages due to gust, storm and other unforeseen aspects. Hence, quantity 03 nos. (01 for test & evaluation, 01 for payload demonstration and 01 as a standby) were catered in the project to meet the stated project objectives. However, the stated project objective of realization of technology for Integrated Aerostat Surveillance System – Medium Size was successfully demonstrated with the usage of two nos. of balloons only (one balloon used for testing, trial & payload demonstration and second balloon kept as standby). Since, no significant damage occurred to the first balloon during trials, it usage was continued for the payload demonstration also and second balloon was kept as standby. Hence, third Balloon was not procured. the standby balloon, kept for contingencies arising from damages due to gust, storm & other unforeseen reasons, was not required to be used in the project as such contingencies never arose."

14. On the alternate use of the balloon, the Chairman-DRDO, during oral evidence, stated as under:

"We have about 1.5 to 2 years’ life available still for that balloon. It is available in the lab. We are trying to make another aerostat to utilise this balloon. Otherwise,

it was kept aside as a standby option to be utilised if and when there is a problem with the first balloon."

15. The Committee also learnt that ADRDE had stated that the integrated aerostat, made up of PU coated fabric balloon, surveillance system was successfully demonstrated during user associated technical trials (UATT) and the project was closed. ADRDE also stated that the other balloon i.e. balloon made of laminated fabric was kept as spare and would have been utilised in case of any damage that might have occurred in unforeseen circumstances.

16. In regard to the procurement of the material, the Chairman-DRDO, during evidence stated:

"Sir, the statement given there that it is procured through an Indian industry is correct. It has been taken as a stand-by. That statement is also correct. The balloon that we have developed indigenously has worked, so the stand-by system could not be utilized. So, both these statements which are written there and what we are saying is also correct. The only thing is that the Army is making the requirements now based on this testing and with that requirement-based system, with some improvements we will be developing and giving it to the Armed Forces."

17. Supplement the above, a representative of DRDO, submitted as under:

" Sir, when we were going for a trial with the Army at their user site, we insisted that trials would be extended to three months, but our PDC is approaching. So, we told them, “You note down all the improvements; we will sit together and we will formulate new QR and based on that new QR we will give you the venue for two years. You can go for trial of all these things and come back.” Sir, that was the solution at that time."

18. Clarifying the position, a representative of Ministry of Defence also supplemented as under:

"Sir, the import of that material was only as a stand-by. Since the indigenous material has succeeded, they have not used it. So, in that sense, it is our submission that the expenditure should not be treated as infructuous because it was part of the project design."

19. The Committee noted that since integrated aerostat was based on a PU coated fabric and they sought to know the precise reasons for importing the balloon with laminated fabric. The Ministry through a written reply informed as under:

> "At the time of project sanction, one of the project objectives was to develop aerostat balloon with laminated fabric. The availability of laminated fabric was already mentioned in project proposal under high development risk area. In spite of all the scientific efforts put in by the Scientists at ADRDE, the required technology for the realization of balloon with laminated fabric was not fully matured. Therefore, the aerostat balloon with laminated fabric was procured. In order to maintain the continuity of system development, as an alternate to laminated fabric, PU coated fabric balloon as per project proposal, was resorted to. At that instant, it was envisaged that testing of various subsystems and initial integration/trials should be continued with PU coated fabric balloon till the laminated fabric balloon is realised. The performance of PU coated fabric balloon was not known a priori. But, during trials, PU coated balloon performed much better than expectations for a longer period and no damage was faced. Since, no significant damage occurred to the PU coated balloon, its usage was continued for the payload demonstration also to explore its performance at fullest and met the Project objectives. Use of indigenous PU coated fabric balloon resulted in a step forward towards self reliance in critical technology. Had the laminated fabric balloon been used in initial development stages of the project, the success of PU coated would not have been known and might have got deprived of self reliance in this technology. The interfaces of all the subsystem of Integrated Aerostat Surveillance System 'Nakshatra' are compatible to both PU coated as well laminated fabric balloons. Therefore, this integrated aerostat system may be deployed with either of the balloons."

20. The Chairman-DRDO, on this aspect, during evidence, submitted as under:

> "They are both two different technologies, Sir. We thought we should pursue both the technologies – polyurethane and laminated fabric based technology. The laminated fabric based technology, right in the beginning of the project, could not be done. So, we thought that the first one should be imported, where we had the confidence to go ahead with the development of polyurethane based product. So, both have been pursued simultaneously and we procured this one. But by the time we procured this, the first fabric was developed indigenously and we started utilizing it and it is good that it has worked. So, the imported one could not be utilized."

21. When the Committee sought details regarding the non utilization of imported balloon and also wanted to know whether the imported balloon was not according to the Army's specifications, the Ministry furnished as under:

"To meet one of the project objectives, Aerostat balloon with laminated fabric was developed for the integration of payload and demonstration. But, by the time laminated fabric balloon was delivered, the results of indigenous PU coated balloon (fabricated as time gap arrangement and meant for initial test purposes) had already started exhibiting its performance far better than the expectations. Hence, to explore its performance at fullest, it was continued to be used during system demonstration trials also. Thus, need did not arise to deploy laminated fabric balloon and it remained as standby during the project completion. Aerostat balloon with laminated fabric was specifically developed based on the design inputs and specifications provided by DRDO not by Army. Further, this laminated fabric balloon was integrated with required simulated subsystems and deployed under controlled conditions at firm premises in India. Subsequently, DRDO Scientists carried out study and analysis on this balloon in respect of its configuration, fabrication & sealing technology involved in laminated fabric, panel and joint analysis, pressure drop study, inflation and deflation techniques, integration of interfaces, static balancing of different loads in inflated conditions etc."

22. During oral evidence, a representative of DRDO, also submitted as under:

"Sir, as our Secretary said, this was a stand-by balloon we kept because balloon is susceptible with winds, gust and different kinds of loads during adverse environment conditions. So, this was as a project strategy that we have kept this balloon as a spare. Now, this balloon will definitely be used, when new QR which we are working with the Army, has been finalised. Then we will definitely utilize this balloon."

23. Since imported balloon was lying idle as a spare, the Committee wanted to know what was the probable alternative for using the same for the benefits of the end users and sought to know the present status of the same and also what was the basket time in which it should have been used or discarded. In this conection, the Ministry furnished as under:

"Certain mandatory data related to fabric structure w.r.t. the joint strength needs to be evaluated under pressure by inflating balloon. Analysis of such data would be useful for futuristic laminated fabric structures. The usage of this balloon is already underway for the aeration test, which has been recently conducted in October, 2018 and has re-ascertained its performance at the required pressure in inflated conditions. During the remaining shelf life of balloon, available payloads would also be integrated for its performance evaluation from December, 2018 onwards. DRDO is having interactions with Users/ Army, who is in the process to finalize the QRs for project NAKSHATRA vide letter no. 55340/ABC (Nakshatra)/SI-11 dated 15th Dec 2017. Currently, the laminated fabric balloon is

being used for comparative study and analysis of panel and joints. As of now, the basket time for this balloon is approximately 2 years."

24. The Committee learnt that the Army stated that the User Associated Technical Trials (UATT) for the system could only be carried out for three days and as such the effectiveness of the COMINT system could not be ascertained. It further mentioned that ADRDE had been requested to deploy the aerostat with the COMINT payload for three months for UATT as it is a pre-requisite to ascertain efficacy before taking over the system for extended trials.

25. When the Committee sought to know the specific reasons for conduction of trials with the indigenous product when the imported balloon was already procured and remained idle, the Ministry furnished as under:

"As per project strategy, the initial integration, testing and subsystem trials with indigenous PU coated balloon were started before delivery of imported balloon itself. The performance of PU coated was not known a priori. However, during trials, PU coated balloon performed as per requirements and met the Project objectives and no significant damage was reported during deployment trials. Hence, use of laminated fabric balloon was not necessitated and it remained as standby. This was a step forward towards self reliance in critical technology."

26. During oral evidence, a representative of DRDO informed the Committee that during trials, Army requested DRDO to extend the trials a little further but they were told that the trial was upto June only and expenditure was not available for trials beyond June. Army was requested to provide their queries and the aerostat would be given to the Army for two years for user trials across the country. Army agreed to the proposal and were apprised that DRDO would give them a new Qualitative Requirement (QR) and would ask the Army for new requirements.

27. Intimating about the stand of DRDO, the Chairman-DRDO, during oral evidence, stated:

"The polyurethane technology was a reasonably matured technology at that time in the country. It has not been made an aerostat of this class by that time at all. What was the period and durability of polyurethane? Also, the laminated technology should be tried which gives a longer life. The laminated technology was not available at that time. We should not try this technology. When we tried small pieces of it, that could not bring good results. So, we placed a contract with

this company. This company has imported parts of it. They have assembled them in their premises and given it to us. If it got failed, then only we could have gone for the imported one. That could have been a question. The leap time for it is more than about an year. So you cannot be waiting as a lull period. So, it has been taken as a mitigation that you should go for the parallel option also simultaneously. As regards details, I will look into the file and get back to you. So, that is how, that has been procured. But it is good that the indigenous material has worked. So, it could not be utilised."

28. When the Committee wanted to know as to what were the constraints felt by DRDO/ADRDE in conducting a trial for three months and consequently for extended trials to the full satisfaction of the Army, the Ministry through a written reply, submitted as under:

"The scope of the project was to develop an integrated aerostat surveillance system in technology demonstration (TD) mode. In TD mode project, the technological capabilities are demonstrated to undertake futuristic requirements in mission mode. In TD mode projects User involvement is not mandatory. Since the developed technology is to be utilized by Army. Therefore, it was a considered opinion to involve the Army i.e. end Users during development phase. Therefore, in this project, all functional aspects of system were demonstrated at Agra and at User designated sites, during User associated technical trials (UATT). Also the interception capabilities of COMINT payload were demonstrated with available frequencies at these trial sites. The know-how about system was imparted to end Users during these trials. Since, all the functional as well as interception capabilities of aerostat mounted COMINT payload were successfully demonstrated which was also endorsed by Users vide their minutes of meeting dated 31st Aug'2016. The project was closed within its date of completion (PDC). However, upon successful completion of the project, the User suggested to incorporate certain additional modification/ improvement in the system along with the extended trials. Based on the deliberations with Army (Refer point 7 & 8 in their minute of meeting), a draft QR has been forwarded to them for approval in order to take up a new project for further improvement in the system (Letter No. ADRDE/QMD/MSG/NAKSHATRA/PS/01 date 19th Oct 2016 and ADRDE/QMD/MSG/NAKSHATRA/PS/01 dated 27th July 2017. The Army vide letter no. 55340/ABC(Nakshatra)/SI-11 dated 15th Dec 2017 intimated that Army is in the process of finalizing the revised QRs for project NAKSHATRA and the same shall be forwarded shortly to ADRDE."

29. The Committee sought reasons from the Ministry for keeping a higher quality product as spare and instead use a lower quality product in the main trials. The Ministry, in this regard, clarified as under:

"At the inception stage of the Project, it was envisaged to use first PU coated balloon during initial integration and testing of subsystems till such time the

laminated fabric balloon is realised. The performance of PU coated was not known a priori. However, during trials, PU coated balloon performed as per requirements and met the Project objectives. Indigenous PU coated balloon met project objectives for a longer period and no damage was faced during flights. This was a step forward towards self reliance in critical technology. Had the laminated fabric balloon been used in initial development stages of the project, the success of PU coated would not have been known and might have got deprived of self reliance in this technology. Furthermore, the country could have remained dependent on import. Through this approach adopted in the Project, the efficacy of PU coated balloon has been proved. At the same time laminated fabric balloon when procured, was deployed with integrated simulated subsystems under controlled conditions and fully tested in India."

30. In summation, the Committee learnt that Para 6.1 of Chapter VI of C&AG's Report No. 15 of 2017 revealed that the Aerial Delivery Research and Development Establishment (ADRDE), Agra spent ₹ 6.20 crore on import of a balloon made of laminated fabric which was not utilized in the project as the project was carried out using polyurethane (PU) coated fabric balloon and the project itself did not achieve its objective despite an expenditure of ₹ 49.50 crore as it was closed without acceptance by the user i.e. Army.

Para No. 6.2: Irregular Sanction and Expenditure of ₹5.20 Crore on Construction of Vehicle Testing Ground after Completion of the Project

31. The Committee found that the Defence Works Procedure-2007 envisage that all defence works and services are to be completed with the minimum delay in a cost-effective manner and that no new works are sanctioned without careful attention to the assets and facilities already available. It was noticed that a Vehicle Testing Ground was constructed in April 2014 at Vehicle Research & Development Establishment (VRDE), Ahmednagar at a sanctioned cost of ₹ 5.20 crore to meet the test requirements of Unmanned Ground Vehicle (UGV) project. However, the Committee found that the Project had already been closed in February 2008, nevertheless the Administrative Approval for the work was accorded by DG (R&D), in April 2009. It is learnt that the requirement for the said vehicle was projected by VRDE in March 2005 to meet the needs of test facilities for the UGV with Gross Vehicle Weight of 10 Ton at a maximum speed of 82 kilometre per hour (kmph).

32. When enquired about the necessity of sanctioning the work after the UGV project had already closed in February 2008, DRDO stated that the UGV testing ground was planned for then ongoing as well as pipeline/futuristic unmanned systems testing and not for any 'specific' project and it was to facilitate an isolated test ground with safety provision for arresting moving UGV, in case of emergency/uncontrollable operation.

33. The Committee also found that the requirement of testing ground was projected specifically to meet the needs of testing the UGV being developed on a 2.5 Ton 'B' vehicle with Gross Vehicle Weight of 10 Ton at a speed of 82 kmph. The trials of this UGV had already been completed utilizing the existing VRDE test tracks, as the Testing Ground was not available then. The project of 2.5 Ton 'B' vehicle UGV was itself closed in February 2008. Thus, the delayed sanctioning of the Testing Ground did not serve the intended purpose. Besides, as the Army is currently in need of UGV of 50 kg capacity only, it is evident that the testing facility is not likely to be optimally utilized. Army in a Project Review meeting (August 2012) had intimated DRDO that the ongoing development of larger UGV would be stopped and henceforth all developments shall be directed to develop the smaller 50 Kg UGV. Also, since construction of the track, the VRDE has had only one project of development of CBRN mini-UGV for reconnaissance and that too a 50Kg UGV for which presently existing ground testing facilities would have sufficed.

34. The Committee wanted to know the reasons for delay in sanctioning of the Project especially when the project PDC was 4 years as the requirement of Vehicle Testing Ground projected by VRDE was in March 2005 and Administrative Approval for the UGV Testing Ground was accorded in April 2009. The Ministry, in this regard, clarified as under:

> "The subject work of provisions of UGV (Un-manned Ground Vehicle) Testing Ground was an independent infrastructure development work and was not a part of any sanctioned project/program, as referred to. This was a multi-disciplinary development work. The case was pursued with due diligence and in accordance with the existing procedure which involved meetings, correspondence & co-ordination with multiple agencies viz. Garrison Engineer, Pune, Chief Engineer, Secunderabad, DCV&E, DCW&E, New Delhi, etc. for reviews, appraisals and

assessment, while VRDE was the user lab. There were many observations, clarifications, deliberations and iterations that took place amongst various agencies to fine-tune the UGV Test Ground requirements to a realizable stage. As such, there were no undue delays, rather, the case was prolonged as it went through critical reviews, mid-course corrections and background job-work to generate data as explained above. The project for Dev of UGV was executed within the stipulated PDC and closed as the objective were met. The referred infrastructure development work was not part of this project. Therefore, development of this infrastructure facility may not be linked with the PDC of any specific project."

35. When the Committee desired to know about the reasons for closing the UGV in February 2008, the Ministry through a written reply furnished as under:

"The project realized the set objectives within the PDC (Feb 2008) and hence was closed. The subject Project titled "Development of Unmanned Ground Vehicle (UGV) [Project no. RDE-P1-04/VRD-46] was sanctioned on 5 Feb 2004 with PDC of 48 months from the date of issue of sanction [Ref Project sanction letter no. DCV/04/5673101/P/01/326/D(R&D) dtd 5 Feb 2008]. The subject project was taken up as Technology Demonstrator project wherein Two prototypes of UGV and one prototype of Pilot System Unit were to be developed within PDC of the project."

36. The Committee noted that the Army had not identified a 2.5 Ton 'B' UGV for their future requirements and wanted to know why was the project then sanctioned for development as the end user had already denied the same. In this regard, the Ministry informed as under:

"The identification of 2.5 Ton 'B' of UGV for this future requirements was based on interaction held with the user's as follows:

- Brainstorming meetings were conducted with Users/Service Officers in Oct. 2003 and Dec. 2003 respectively, during pre-sanction phase of the project. The purpose of these meetings was to generate inputs for the proposed TD UGV project. It was recommended by Army that "for development purpose, vehicle already inducted in army should be considered (viz 1/2 ton, 2.5 ton) for avoiding inventory problem during induction in the Army.
- Based on the recommendations of User's in these meetings, 2.5 Ton 'B' vehicle platform i.e. TATA 713 was selected for development of UGV Technology as, it was already inducted in army and its payload capacity of 2.5 ton matches with the need for complying to the operational requirements.

Undertaking TD project was relevant as a proactive approach by DRDO and technology base has been established in the field of Unmanned Ground Vehicle systems/Technologies."

37. When the Committee asked the Ministry to justify the conduct of trials of other vehicles from January 2014 when the testing ground was specifically constructed for UGV testing, the Ministry furnished as under:

The UGV testing round was utilized only for testing of UGVs and systems thereof for various activities such as endurance trials, proving trials, design validation, performance evaluation etc. The vehicles with BA no. as shown in the table below refer to UGVs, which are Tele-operated/Autonomous. These were tested at the UGV Testing ground from 2011 to 2018.

The following table depicts specific details with quantification of running km for tele operated TD UGVs (UGV-I & UGV-II, s no. 1 to 4) and Autonomous UGV (AUGV, s.n. 5 to 9).

Sl. No.	UGV BA No.	Year	Test/trials	Km
1.	UGV-I BA V- 1057	2011	Endurance Trials	303
2.	UGV-II BA V - 1093	2011	Endurance Trials	1584
3.	UGV-I BA V - 1057	2012	Endurance Trials	243
4.	UGV-II BA V - 1093	2012	Endurance Trials	820
			Total	**2950 km**
5.	AUGV BA V - 1147	2014	Testing/Trials	127
6.	AUGV BA V - 1147	2015	Testing/Trials	208
7.	AUGV BA V - 1147	2016	Testing/Trials	103
8.	AUGV BA V - 1147	2017	Testing/Trials	1117
9.	AUGV BA V - 1147	2018 (Jan 18 to June 18)	Testing/Trials	504
			Total	**2059 km**
			Grand Total	**5009 km**

38. On being sought details of vehicles tested including Gross Vehicle weight etc., the Ministry furnished as under:

S. No.	UGV BA no.	Year	Test/trials	Km	GVW, Payload
1.	UGV-I BA V- 1057	2011	Endurance Trials	303	7.5 Ton, 2.5 Ton
2.	UGV-II BA V - 1093	2011	Endurance Trials	1584	7.5 Ton, 2.5 Ton
3.	UGV-I BA V - 1057	2012	Endurance Trials	243	7.5 Ton, 2.5 Ton
4.	UGV-II BA V - 1093	2012	Endurance Trials	820	7.5 Ton, 2.5 Ton
			Total	**2950 km**	
5.	AUGV BA V - 1147	2014	Testing/Trials	127	1.6 Ton, 0.35 Ton
6.	AUGV BA V - 1147	2015	Testing/Trials	208	1.6 Ton, 0.35 Ton
7.	AUGV BA V - 1147	2016	Testing/Trials	103	1.6 Ton, 0.35 Ton
8.	AUGV BA V - 1147	2017	Testing/Trials	1117	1.6 Ton, 0.35 Ton
9.	AUGV BA V - 1147	2018 (Jan 18 to June 18)	Testing/Trials	504	1.6 Ton, 0.35 Ton
			Total	**2059 km**	
			Grand Total	**5009 km**	

39. The Committee were also supplied the details of the project relating to the development of technology for autonomous UGV sanctioned in May 2015 by the Ministry which as under:

> "Project Title: Development of Technologies for Autonomous UGV & Testing on Automotive platform
>
> Sanction date : 01 May 2015, PDC: 30 April 2018
>
> The main objective is to develop technologies for Autonomous Unmanned Ground VEHICLE (AUGV), integrate & to carry out testing/trials of the same on a test platform vehicle. The following sub-systems/modules constitute AUGV technologies:
>
> 1. Vehicle Control Module (VCM)

2. Vehicle Supervisory Module (VSM)

3. Power Supply Module (PSM)

4. Operator Control Unit (OCU)

5. Vehicle Localization Module (VLM)

6. Vehicle Perception Module (VPM)

7. Vehicle Navigation Module (VNM)

8. Vehicle Actuation Module (VAM)

9. Fails-Safe Module (FSM)

10. Advanced Communication Software Protocol (ACSP)

All these modules/sub-systems have been integrated & tested on an automotive test platform. Testing and Demonstration of these carried out at UGV Testing Ground of VRDE."

40. Conclusively, the Committee found that the Director General, Research & Development had accorded sanction for construction of Vehicle Testing Ground at Vehicle Research & Development Establishment (VRDE), Ahmednagar at a cost of ₹ 5.20 crore in April 2009 based on VRDE's proposal of March 2005 to meet the specific requirement of testing the Unmanned Ground Vehicle (UGV) being developed on 2.5 Ton 'B' vehicle. However, by then UGV Project was closed. The expenditure was rendered infructuous because the Testing Ground could not be gainfully utilized as Army's requirement was for a 50 kg UGV for which the existing VRDE Test Tracks would have sufficed.

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PART-II

OBSERVATIONS AND RECOMMENDATIONS

Para 6.1 Development of an Integrated Aerostat Surveillance System

1. In their examination of Para 6.1 on "Development of an Integrated Aerostat Surveillance System" based on the C&AG's Report No. 15 of 2017, the Committee observed that the very purpose of import of a balloon made from laminated fabric was to attain the objective of a medium sized aerostat without the constraints of endurance and shelf life as experienced using a polyurethane (PU) coated fabric aerostat. However, the balloon imported by the Aerial Delivery Research and Development Establishment (ADRDE), Agra for research purposes militates against the project's objective as consequently neither the aerostat was deployed nor Communication Intelligence (COMINT) payload was tested for the duration desired by the Army. Also, the claim about usage of the imported balloon with laminated fabric as a spare to cater for the unforeseen circumstances is incomprehensible to the Committee as the intended objective has not been achieved even after incurring to a total expenditure of ₹ 49.50 crore, out of which an amount of ₹ 6.20 crore pertained to importing of laminated fabric balloon, which remained idle eventually.

2. The Committee note that the technical specification of project 'Nakshatra' specified the use of laminated fabric for aerostat to sustain a working life of 5 years and for continuous operability for 14 days. However, they are dismayed to note that PU fabric coated balloon was used for trials which was of a lower quality than imported balloon made up laminated fabric. What can be more disconcerting for the Committee than the fact that imported balloon; though of superior quality, was never put to any field trial and was kept as risk mitigation strategy.

3. The Committee do not concur with the assertion of either the Ministry or the DRDO that the Project met its set objectives and hence the use of laminated fabric balloon was not necessitated. The Committee are confounded at the fact that as to why, in the first instance, the balloon was imported if the purpose could

have been achieved with indigenous product. It clearly depicts the lack of foresight and planning on the part of DRDO as at no stage of the examination, the Committee could find DRDO coming up with the alternative use of the imported balloon in case the domestic product proves to be successful.

4. Here, the Committee would also like to highlight the fact that the Army also expressed reservations about the effectiveness of the balloon during the User Assisted Technical Trials (UATT). The Committee has every reason to believe that DRDO was more interested in developing/importing a foreign made balloon rather than ensuring that the end-user is fully satisfied with the product delivery. Non-extending the trials further on the ground that expenditure was not available for the same, is evidently an amiss on the part of the DRDO. Instead they came out with alternative suggestions of seeking queries from the Army after giving them for 2 years user trials across the country. The Committee also note with concern that since the completion of project, the Army has still not finalized the qualitative requirements (QR) for the aerostat project. The Committee, in this regard, recommend that an internal inquiry be set by DRDO to find out the reasons for these lapses and the avoidable expenditure which proved to be infructuous.

5. Another glaring issue which has come up not only during the examination of this para but in other subjects relating to DRDO is the delays and cost escalation in their projects. This particular project viz. Nakshatra was initially sanctioned in July 2011 at the cost of 48.80 crore. However, the project cost was consequently revised to Rs. 58.80 crore in October 2013 with the revised probable date of completion (PDC) June, 2016 instead of the original one, i.e., December, 2014. Although the project was completed at a cost of 49.50 crore finally, the Committee are in a dithering state as to why the project cost was hiked to the tune of almost 10 crores and then the same was also not utilized. This is undoubtedly a case of wrong financial projections and goes against the principles of prudent financial management. If seen in the backdrop of extending the field trials for the Army by DRDO on the ground of lack of funding, this issue assumes special significance. The Committee in no uncertain words recommend

that the internal inquiry as recommended in the preceding paragraph should also cover these aspects and responsibility be fixed, if required, under intimation to the Committee. They also recommend that all-out efforts be made to obviate instances of such nature which include wasteful expenditure as well as cost and time escalations. At least now, they be apprised of the outcome of the Qualitative Requirements as finalized by the Army.

Para 6.2 ***Irregular sanction and expenditure of ₹5.20 crore on construction of vehicle testing ground after completion of the project***

6. In regard to Para No 6.2 on "Irregular Sanction and Expenditure of ₹ 5.20 Crore on Construction of Vehicle Testing Ground after Completion of the Project", the Committee observe that sanction was accorded for construction of a Vehicle Testing Ground at Vehicle Research & Development Establishment (VRDE), Ahmednagar at a cost of ₹ 5.20 crore in April 2014. The Project was based on VRDE's proposal of March 2005 to meet the specific requirement of testing the Unmanned Ground Vehicle (UGV) being developed on 2.5 Ton 'B' vehicle. However, the UGV Project was already closed in February, 2008.

7. The Committee find that UGV Testing Ground was proposed as a long term vision for testing UGVs in lighter to heavier weight categories for current/planned/futuristic projects. However, they note with dismay that the project for testing and developing a 2.5 ton 'B' vehicle UGV was already closed in February, 2008 but the track was constructed in April, 2014. The Committee are baffled to learn as to why the DRDO in the first instance brought out a proposal for developing the testing ground for 2.5T 'B' vehicle whereas the Army's proposal was for development of a smaller 50 kg UGV. During their examination, the Committee have been given to understand by the Ministry as well as DRDO that the ground is being tested for UGVs, which includes endurance trials also. The Committee from this assertion understand that the testing ground once created is currently being utilized for related vehicles but not explicitly for 2.5 T 'B' UGV. In their firm opinion, it is again a glaring instance of lack of proper

planning and foresight on behalf of DRDO. It is disquieting to note that DRDO proceeded with the development of the track even when the Project was closed as early as 2008. The Committee, therefore, recommend that DRDO should look into the entire issue afresh and come out with the reasons as to why this track was developed without taking into consideration the specific requirements of the end-users. They also recommend that DRDO should revisit and constitute firm guidelines for initiating any research for the users in future and not commencing any project suo motto. They also recommend fixing the responsibility in the matter for any deviation from the Defence Works Procedure-2007 which envisages that all defence works and services are to be completed with the minimum delay in a cost-effective manner and that no new works are sanctioned without careful attention to the assets and facilities already available.

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NEW DELHI;
December, 2018
Agrahayana, 1940 (*Saka*)

MALLIKARJUN KHARGE
Chairperson,
Public Accounts Committee.