NATIONAL SECURITY WITH SPECIAL REFERENCE TO PRODUCTION OF BEL: AN OUTLOOK

S Rajagopal[1]

[1]*Assistant Professor, Department of History, Mannar Thirumalai Naicker College, Madurai, India*

Abstract

Bharat Electronics Limited (BEL) is a Navratna, Defence Public Sector Undertakings industry. It had answerable to distribute the eminence of instruments in time to the Armed Forces and stressed the need to build up the technology and industrialized base inside of the nation. BEL equipments are preventing security threats of India's land, Naval and Aerial borders from enemies and anti national elements. Apart from own production by BEL, also in collaboration with DRDO and manufactures sophisticated technological security related equipment for Indian Armed forces. BEL's armed force related productions during the year 2017-18 is increased as compare to 2002-13 and registering a historic growth of 14%. Besides only 11% of BEL defence related products came on Transfer of Technology from foreign OEMs. As a developing nation, India also took part exported defence equipment into some friendly countries, which is a positive indication.

Key Words: Bharat Electronics Limited (BEL) Security Related Productions, BEL Strategic Alliance with Foreign OEMs, Indian Defence Industry, Indian Boundaries & India's Neighbouring Threat.

1. Introduction

Geographical location and connectivity of Indian states created a variety of challenges on the development and security fronts. India has 15,106.7 kms of land border and a coastline of 7,516.6 kms as well as island territories. The span of our territory boundaries with nearby nation is sharing with China by 3488 kms; Pakistan by 3,323 Kms; Afghanistan by 106 kms; Bangladesh by 4,096.7 kms; Nepal by 1751 Kms; Myanmar by 1,643 Kms and Bhutan by 699 Kms.[1] Due to broad range of Indian land and coastal borders, India faces complicated internal safety and external challenges. Since independence, India has taken part in Kashmir Operation against Pakistan in 1947-48; Sino-Indian Operations in North-East Frontier Agency in 1962; Indo-Pak War 1965; Indo-Pak War 1971 and Kargil War 1999. For prevention of nation land, coastal and aerial boundaries from enemies, India diplomatically deployed very huge defence forces. Also installed broad defence technology equipment manufactured by Defence Public Sector Undertakings (DPSUs) industries such as Bharat Electronic Limited (BEL), Bharat Dynamic Limited (BDL) and Hindustan Aeronautical Limited (HAL) etc. BEL, Bengaluru equipments are preventing security threats of India's land, Naval and Aerial borders from enemies and anti national elements. 85% of BEL's indigenous security related equipments are deployed within homeland.

2. Objectives

The core objective of the present study is focused:-

2.1 To know the Armed forces security related equipment of BEL.

2.2 To study last 10 years amount of production of BEL.

2.3 To know important collaboration security related equipments with Defence Research & Development Organisation (DRDO).

2.4 To try hard for self-reliance through indigenisation.

2.5 To bring out BEL defence security production alliance with Foreign Original Equipment Manufacturers (OEMs).

3. Methodology

The present paper gives an importance on national security and BEL defence related equipment production. For research, both primary and secondary sources are used. Most of the primary sources data have been collected from Annual Report of Ministry of Defence (MoD), Bharat Electronics Limited (BEL) and Bharat Dynamics Limited (BDL).

4. Neighbouring Threat

India encounters twin problems. One side there is a large scale strengthening of our neighbours through supply of arms and secret support to their nuclear and missile programmes and on the other side India weaken our indigenous technology.[2] In past, Pakistan had employed an irregular it's in war with India in 1947, 1965, 1971 and 1999. Now it is mass producing more sophisticated well armed and trained 'mujahedeen'. India has to prepare for a complicated hybrid war contingency in any future conflict with Pakistan. [3] It is seen that increased Chinese military presence on India's northern borders and challenge all tri-junctions along India's northern boundary: Eastern tri-junction of India-Tibet-Bhutan in the Tawang sector; India-Tibet-Myanmar in the Lohit sector of Arunachal Pradesh; Batang La in the Eastern Sikkim (Doklam); Finger in North Sikkim not far from the Eastern tri-junction of India-Tibet-Nepal; and now the Western tri-junction of India-Tibet-Nepal in the Kalapani- Lipulekh sector. China's continued by provocative intrusions in Barahoti in Uttrakhand sector and Pangong Tso in Ladakh sector.[4] Also China's growing naval presence in the Indian Ocean because 'Chinese naval presence in the Indian Ocean', means that India may to enhance the strength of its Eastern Fleet [5] with high sophisticated present and future generation equipment.

5. Defence Force Deployment

Indian Military is protecting land boundaries beside the Life of Control (LoC) on Pakistan boundaries and Line Actual Control (LAC) on China border. In addition, in Myanmar boundary by Assam Rifles; China boundaries by Indo-Tibetan Border Police (ITBP); Bangladesh and Pakistan boundaries Indian Border Security Force (BSF); Nepal and Bhutan boundaries by Sashastra Seema Bal (SSB) are deployed and performed tasks in extreme intensity atmosphere condition. Indian Navy is answerable for overall maritime protection which includes coastal and offshore safety. Indian Coast Guard has been additionally designated as authority answerable for coastal security in India's territorial waters including areas to be patrolled by the Coastal Police. For more eye to eye watch guard of homeland borders, Indian armed forces are essential to deployment of extremely advanced equipments mandatory.

6. Indian Defence Expenditure

For build-up a strong supervision of Indian Defence forces, funding division in the MoD deals along with all matters having a fiscal proposition, organize and scrutinize Armed Forces Estimates. Break-up of the actual India Defence spending (Army, Navy, Air force, R & D, Ordnance Factories and Quality Assurance) during the last 10 years data base from 2009-10 to 2015-16; the Revised Estimates for 2016-17 and allocation of budget 2017-18 & 2018-19 are given **Table 1.** below.[6]

Table 1. Indian Defence Expenditure Share 2009-10 to 2018-19

S. No	Year	Army	Air Force	Navy	DR&D@	DDP#	Total
		(Rupees in Crore)					
1.	2009-10	75228.00	32790.86	22693.59	8475.38	2593.25	141781.08
2.	2010-11	78239.69	38176.49	27119.20	10148.92	432.41	154116.71
3.	2011-12	84081.29	45614.01	31115.32	9893.84	665.19	170913.28
4.	2012-13	91450.51	50509.13	29593.53	9794.80	695.67	181775.78
5.	2013-14	99464.21	57708.63	33393.21	10868.89	2064.41	203499.35
6.	2014-15	114559.95	52537.48	35948.53	13257.98	2390.24	218694.18
7.	2015-16	114329.37	52219.27	34866.73	13289.27	1968.69	216673.33
8.	2016-17	131283.69	52057.38	37410.27	13153.54	3139.70	237045.58
9.	2017-18[7]*	149369.00	58373.00	37842.00	14819.00	1988.00	262391.00
10.	2018-19[8] *	154902.00	64591.00	40420.00	17861.00	1531.00	279305.00

* MoD's total allocations only

@ Defence Research & Development

\# Department of Defence Production

6.1 As can be seen from the Table 1, the share of Indian Defence forces, Defence Research & Development and Department of Defence Production expenditure has been growing constantly since 2009-10 onwards. A large part of this boost has come at the cost of the modernisation budget which is strong Indian defence attentiveness.

7. Indian Defence Industry

Technology is one of the most imperative needs for a nation to become developed; this is what our former President Dr. A.P.J. Abdul Kalam strongly believes. But this technology shall be competitive enough to face the contest into international standard.[9] India is a developing country and follows a policy of self sufficient, when it comes to arms production. Self-sufficiency/reliance has been the primary reason for developing a vast defence industrial foundation, which now comprises 52 defence laboratories and establishments under DRDO; and 9 DPSUs and 39 ordnance factories under the DDP of MoD.[10] In the past, the MoD largely depended on the DPSUs and imports to meet India's security needs. The 'Make in India' idea has made a huge impact on the domestic territory and encouraged the PSUs to participate government projects with confidence. Indian DPSUs has the potential to set up the most excellent

of the technology accessible worldwide, invest large finances and produce state-of-the-art equipment in the motherland. India has 'Nine DPSUs organizations under the Department of Defence Production' are HAL; BEL; BDL; Mishra Dhatu Nigam Limited (MIDHANI); Bharat Earth Moving Limited (BEML); Garden Reach Shipbuilders & Engineers Limited (GRSE); Hindustan Shipyard Limited (HSL); Mazagon Dock Shipbuilders Limited (MDL); Goa Shipyard Limited (GSL); and Ordnance Factory Board (OFB).[11] DPSUs are by far the biggest players in the Indian defence manufacture division and have consequently a larger role in the country's self-reliance drive. The amount of fabrications of DPSUs/ Ordnance Factories is mentioned in **Table 2.**

Table 2. Indian Defence Industry Productions from 2010-11 to 2017-18 (In Crore)

Name of the DPSUs	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
HAL[12]	16450.00	12693.00	14202.00	15868.00	16288.00	17152.00	17163.00	17553.00
BEL	5520.80	5793.58	6289.91	6126.90	6658.54	7775.37	9243.83	9705.95
BDL [13]	910.98	992.94	1175.52	1804.49	2770.05	4297.83	5011.00	4641.30
BEML [14]	3429.57	3504.32	3091.64	3181.15	2645.32	3147.69	2806.82	3277.62
MIDHANI [15]	4754.73	4832.88	5326.71	5641.76	6400.45	6785.37	6956.40	6976.76
GRSE [16]	1053.30	1292.53	1229.15	1611.67	1612.66	1660.75	927.84	
GSL [17]	990.32	676.43	506.62	508.90	569.55	725.96	1030.20	
HSL [18]	603.84	564.00	484.00	453.40	294.16	593.29	404.32	-
MDL [19]	2611.41	2523.69	2290.64	2865.51	3592.60	4106.22	3523.67	
OFB [20]	15389.58	12391.00	11975.00	11123.00	11364.00	13047.00	8398.00	

7.1 As can be seen from the Table 2, the share of production of Indian Defence Industry has been growing regularly since 2010-11 onwards. A large part of this increase has come at the cost of the modernisation of Indian defence forces.

7.2 DPSUs production are some of the main sell overseas countries for defence products have been Algeria, Afghanistan, Nepal, Myanmar, Ecuador, Israel, Oman, Russia, UK, Indonesia, Vietnam Romania, Belgium, Sudan and South Korea. The most important defence items being exported are Offshore Patrol Vessels, Cheetal Helicopters, Personal Protective Items, Spares for Radar, Light Engineering Mechanical Parts, Turbo Chargers and Batteries, Electronic Systems (EOPOD ALH System), etc.[21]

8. Bharat Electronics Limited (BEL)

In the later 1950s, the border anxiety with Republic China and 1954 US-Pakistan strategic joint venture a turning point of India's history. India started mission for self-sufficiency; and BEL, was launched in 1954 with French support [22] by the Ministry of Defence in Bangalore, to assemble the specialized requirements of the defence equipments.[23] The company has grown into a multi-product, multi-technology and multi-unit organization, now employing 9726 employees and serving the requirement of customers in various fields around India and overseas.[24]

9. BEL, Defence Production

BEL had answerable to distribute the eminence of instruments in time to the Armed Forces and stressed the need to build up the technology and industrialized base inside of the nation. BEL defence industry develops and deployed indigenous equipment for armed forces of present and future needs. For the nation's Armed Forces security building, 'BEL produces some of the under mentioned imperative equipments':- [25]

9.1 Handheld UHF Radios.

9.2 Secure Communication Network.

9.3 Fire Control Systems (FCS).

9.4 Battle Field Surveillance Radar (BFSR).

9.5 3-D Central Acquisition Radar (Rohini).

9.6 Surveillance Radar Element (SRE).

9.7 Artillery Combat Command Control System (ACCCS).

9.8 L-Band Surveillance Radar (LBSR).

9.9 Shipborne Electronic Warfare System (SEWS).

9.10 Integrated Communication Network System for ships (ICNS).

9.11 Mobile Radar band Electronic Intelligence System.

9.12 Mobile Communication Terminal (MCT).

9.13 Passive Night Vision Weapon Sight (PNVWS) and

9.14 Doppler Weather Radar.

9.15 BEL, R&D expenditures and export

BEL have nine fabrication units [26] along with R&D, which has been the nucleus potential of BEL. A different section of BEL is concentrating in enlargement of tactical Components, equipment modules, Subsystems and System of Systems. Apart from domestic efforts, BEL R&D Engineers are functioning with Indian Space Research Organisation, Council of Scientific & Industrial Research, DRDO, various nationwide Research Laboratories and educational organizations for mutual improvement.[27] Navratna DPSUs, BEL is vast powerful on R&D and focused especially on design and improvement. Now, BEL spends 9.8% on R&D [28] is expected to next three to five years will grow beyond 10 to 12 %.[29] BEL security related equipment contribution to the defence services is 85 % of the turnover. [30] It is the thrust for indigenous developments that led to achieve an average 78% to 89% of turnover from indigenous products, 11% to 22% of revenues came from products manufactured by Transfer of Technology from foreign Original Equipment Manufacturers. Last eight years percentage of growth rate, indigenous products, R&D expenditures and export details mentioned in Table 3.[31]

Table 3. Details of BEL, Growth, Indigenous Products and R&D Expenditures Percentage

S. No	Year	Growth %	Indigenous products %	R&D expenditure of turnover %	Export (US $ in Millions)
1.	2010-11	5.94	78	7.00	41.53
2.	2011-12	3.15	81	8.20	38.45
3.	2012-13	5.40	78	8.50	70.64
4.	2013-14	2.70	85	7.56	42.00
5.	2014-15	8.43	80	8.20	57.85
6.	2015-16	16.31	86	9.36	85.00
7.	2016-17	17.00	87	8.81	65.50
8.	2017-18	14.00	89	9.80	26.30

9.16 BEL, Value of Productions

In the last 16 years, from 2002-03 to 2017-18, BEL value of national security related production has increased from Rs 2536.39 crore to Rs 9705.95 crore; the profit also increased from 260.61 crore to 1399.29 crore and employees strength decreased from 13750 to 9726. The details can be seen from the **Table 4** [32]

Table 4. BEL, Value of Production from 2002-103 to 2017-18

S. No	Year	Total Value of Production (Rupees in Cores)	Profit After Tax (Rupees in Cores)	Employs	S. No	Year	Total Value of Production (Rupees in Cores)	Profit After Tax (Rupees in Cores)	Employs
1.	2002-03	2536.39	260.61	13750	**9.**	2010-11	5520.80	861.47	11180
2.	2003-04	2807.83	316.10	13038	**10.**	2011-12	5793.58	829.90	10791
3.	2004-05	3234.97	446.32	12390	**11.**	2012-13	6289.91	889.83	10305
4.	2005-06	3450.03	583.01	12262	**12.**	2013-14	6126.90	931.62	9952
5.	2006-07	4012.75	718.16	12357	**13.**	2014-15	6658.54	1167.24	9703
6.	2007-08	4111.37	826.74	12371	**14.**	2015-16	7775.37	1307.36	9848
7.	2008-09	5273.27	745.76	11961	**15.**	2016-17	9243.83	1547.62	9716
8.	2009-10	5247.88	720.87	11545	**16.**	2017-18	9705.95	1399.29	9726

10. Indigenous Designed Akash Missile

Native designed and fabricated supersonic surface-to-air missile, Akash is the product of booming partnership of thirteen DRDO laboratories; nineteen PSUs including BDL & BEL; six Ordinance Factories; three nationalized laboratories; 6 academic organization, and some major Private engineering establishment such as Tata Power and

L&T.[33] The medium-range portable surface missile arrangement can intention aircraft up to 30 km, on height up to 18,000 meters has been installed into the Indian Air Force (IAF). Akash missile is created with collaboration of BDL and BEL.[34] The multitarget, multi-directional, all weather air-defence organism consisting of observation and tracking radars, control hubs and ground maintain systems accumulated on high mobility transport for the military version is designed to allow incorporation with other airborne security command and control systems through safe communication contacts. BEL & BDL is the main fabrication agency along with a large number of other industries. [35]

11. DRDO Transfer Technology To BEL

DRDO transferred eight technologies to seven industries from private and public sector in the presence of Defence Minister Smt. Nirmala Sitharaman in Def Expo India–2018 held near Chennai, on 11th April 2018. The technologies transferred to industry partners included: ASTRA Missile to M/s BDL, Hyderabad; Heavy Weight Torpedo Varunastra to M/s BDL, Hyderabad; Anti-Thermal/ Anti Laser Grenade to Ordnance Factory, Dehu Road; Identification of Friend and Foe to M/s Data Pattern, Chennai, BEL, Bengaluru; HUMSA–UG Sonar and ABHAY Sonar to BEL, Bengaluru. This will give an important growth to the "Make in India" agenda foresee the government of India.[36]

12. GBMES

The Ground Based Mobile Electronic Intelligence System (GBMES) to search, detect, monitor, verification and progression the hostile emissions as well as to find out the site of the emitter fulfilling the strategic electronic warfare needs of the IAF. The equipment receive signal from 70 MHz – 40 GHz signals and monitors the message Intelligence signals. The GBMES was handed over to the IAF by the BEL on 18th March 2018. DRDO is answerable for the system design and expansion of the organization. BEL is the fabrication organization for GBMES.[37]

13. Unmanned Aerial Vehicle (UAV)

DRDO effectively passed out the foremost journey of TAPAS 201 (Rustom– II), native step up of UAV. Rustom- II has been planned and developed by DRDO with BEL, is one of the fabrication partners. [38]

14. NBC Inflatable Shelter

In Nuclear Biological and Chemical (NBC) environment, individual protection in the battleground is possible only for a limited period. Inflatable NBC Shelter provides uncontaminated surroundings against Chemical, biological, radiological (CBR) threats for 48 hrs along with Life Support System to 10 personals and command and control centre. The shelter can be adopted for variety of roles. BEL is a Industry partner involved NBC Shelter to 10 persons and command and control centre.[39]

15. Swathi Weapon Locating Radar

It is a portable weapon locating radar fabricated by BEL and DRDO has been handed over to the Indian Army. The counter-battery radar is projected to recognize and track inward artillery & rocket fire to decide the aim of source for counter-battery fire.[40]

16. SDR For Navy

BEL, Bengaluru, is the development-cum-production agency of Software Defined Radio (SDR), which is a DRDO production. It contains five different SDRs form factors (SDR-Tactical, SDR-Naval Communication, SDR Hand-held, SDR Airborne and SDR-Manpack) and associated waveforms as per the Navy's requirements. These five-form factors would address needs of Indian Navy for surface, ships, specific air platforms and marines. The ship-borne SDR family will help networking of naval battlefield resources on the move and enhance Indian Navy's operational capability many-fold. SDR Navy would act as a catalyst for indigenous development of SDRs for other service wings and internal security organizations. Ministry of Defence, has done work on design and development of legacy, High Frequency and L-band waveforms and also high level network management software.[41]

17. Maareech For Navy

Maareech is proficient of discovering, tracking, seducing, puzzling & distracting inward new torpedoes for Navy. Utmost pulling speediness of Maareech has 32 knots and 10-24 knots strategic operational fleetness. Productionization of two fabrication of Maareech fire manages system and 40 of replaceable decoys had finished by manufacture organization of BEL.[42]

18. BEL, Strategic Alliance With Indian & Foreign OEMS

BEL has initiated and progression for signing agreements by the successive major Indian Platform firms Larsen & Toubro Limited, Mumbai, Mahindra Defence Systems Limited, Mumbai; Goa Shipyard Limited, Goa and Mazagaon Dockyard Limited, Mumbai. Also BEL proposed strategic alliance with foreign OEMs of defence's equipment to address global markets by offering the best worth offer is given below:-[43]

18.1 **ELOP, Israel** – Electro-optics.

18.2 **ELBIT, Israel** – Airborne Electronic Warfare (EW), Thermal Imaging Fire Controlling System (TIFCS), Specific Absorption Rate (SAR) and Helmet Mounted Display System.

18.3. **CONTROP, Israel** – Night Vision and Laser Equipment.

18.4 **MEPROLIGHT, Israel** – Co-production agreement for Long Range Finders(LRFs), Grenade Launchers(GLS) and Day Sights for small Arms.

18.5 **SAAB, Sweden** – Marketing agreement for various equipments.

18.6 **BERETTA, ITALY** – MoU for supplying of Reflex Sight and NVDs for Assault / Sniper Rifle for Global requirement.

19. Conclusion

Indians must all work together to convert our developing Nation into a developed Nation. Homeland security related production mission could reach an efficient and effective manner due to a well developed Quality Management System. Now, it is noticed that India is speedily emerging in defence fabrications. The present Indian government initiated 'Make in India' strategy which encourages indigenous defence fabrications and wants to make India as a large exporter nation. BEL has meticulously designed and developed indigenous Armed forces related various sub-systems of Rohini Radar, SRE, ACCCS, BFSR, LBSR, FCS, SEWS, ICNS, Mobile Radar Band Electronic Intelligence System, MCT, Handheld UHF Radios, SCN and PNVWS. These all equipments are preventing security threats of India's land, naval and Aerial borders from enemies and anti national elements. BEL, in collaboration with DRDO and manufactures sophisticated technological security related equipment for Indian Armed forces. BEL's armed force related productions during the year 2017-18 is increased 3.82 times as compare to 2002-13. 85% of BEL's indigenous security related equipments are deployed within homeland. Besides only 11% of BEL defence related products came on Transfer of Technology from foreign OEMs. As a developing nation, India also took part exported defence equipment into some friendly countries, which is a positive indication. BEL will become to reach world advance security related manufacture in future developed India.

Acknowledgments

I take this wonderful opportunity to extend thanks to all individual, groups of authors, IDR and IDSA whose published information referred for this academic study. I extend my enormous gratitude to GOI, MoD, MHA, DRDO and DPSUs industries & OFB, whose online Annual Report data referred and very useful for this study.

REFERENCES

[1] GOI, *MHA, AR 2017-18*, New Delhi, 2018, p.30.

[2] Kalam, A.P.J. Abdul and Rajan Y.S., *India 2020: A Vision for the New Millennium*, Viking, New Delhi, 1998, p.20.

[3] Bajwa (ed.), Lt. Gen. J.S., *Indian Defence Review (IDR),* July-Sep 2015,Vol.30(3), New Delhi, 2015, pp.3-7.

[4] Bajwa (ed.), Lt. Gen. J.S., *IDR*, July-Sep 2017,Vol.32(3), New Delhi, 2017, pp.1-6.

[5] *Standing Committee on Defence*, 'Demands for Grants (2012-13),' Ministry of Defence, New Delhi, 30 April 2012, pp. 70-71.

[6] GOI, *MoD, AR 2002-03 to 2016-17,* New Delhi.

[7] Behera, Laxman Kumar, *India's Defence Budget 2017-18: An Analysis*, IDSA, New Delhi, 2017, p.5.

[8] Behera, Laxman Kumar, *Defence Budget 2018-19: The Imperative of Controlling Manpower Cost*, IDSA, New Delhi, 2018, pp.1-10.

[9] Jindal .S.K., (ed.), *DRDO Science Spectrum 2013*, DRDO, DESIDOC, Delhi, 2013, p.19.

[10] Behera, Laxman Kumar, *Indian Defence Industry : An Agenda for Make in India*, IDSA, Pentagon Press, New Delhi, 2016, p.1

[11] GOI, *MoD, AR 2016-17*, New Delhi, 2017, p.52.

[12] HAL, *55th AR 2017-18*, Bengaluru, 2018, pp.16-17.

[13] BDL, *48th AR 2017-18*, Hyderabad, 2018, p.19; and BDL, *42nd AR 2011-12*, Hyderabad, 2012, p.iv.

[14] BEML, *54th AR 2017-18*, Bengaluru, 2018, p.1.

[15] MIDHANI, *AR 2017-18*, Hyderabad, 2018, p.17.

[16] GSRE, *AR 2016-17*, Kolkata, 2017, p.10.

[17] GSL, *AR 2016-17*, Goa, 2017, p.87.

[18] GOI, *MoD AR 2011-12 to 2016-17*, New Delhi.

[19] MDL, *AR. 2016-17*, Mumbai, 2017, p.55.

[20] GOI, *MoD AR 2011-12 to 2016-17*, New Delhi.

[21] GOI, *MoD, AR 2015-16*, New Delhi, 2016, p.58.

[22] Behera, Laxman Kumar, *Indian Defence Industry : An Agenda for Make in India*, IDSA, Pentagon Press, New Delhi, 2016, p.1.

[23] *9th Standing Committee Report on Defence 2005-06*, 14th Lok Sabha, 'Defence Public Sector Undertakings', Lok Sabha Secretariat, New Delhi, p.17.

[24] BEL, *AR 2017-18*, Bengaluru, 2018.

[25] BEL, *AR 2010-11*, Bengaluru, 2011, p.7.

[26] BEL, *AR 2016-17*, Bengaluru, 2017, p.1.

[27] BEL, *AR 2012-13*, Bengaluru, 2013, p.19.

[28] BEL, *AR-2017-18*, Bengaluru, 2018, p.1.

[29] Money Control dated 16th February, 2017 quoted in Newspaper Clipping Service, *DRDO at Aero India 2017, Special Edition*, 11th February, 2018 to 18th February 2017, DESIDOC, Delhi, pp.25-26

[30] BEL, *AR 2013-14*, Bengaluru, 2014, p.1.

[31] BEL, *AR 2010-11 to 2017-18*, Bengaluru.

[32] BEL, *AR 2012-13 to 2017-18*, Bengaluru.

[33] Suri Alka (ed.), *DRDO News Letter (NL),* Vol.38, Issue.3, March 2018, DESIDOC, Delhi, 2018, p.14.

[34] *Ibid*., p.8.

[35] Jindal S.K. (ed.), *DRDO NL,* Vol.34, Issue.4, April 2014, DESIDOC, Delhi, 2014, pp.4-5.

[36] Suri Alka (ed.), *DRDO NL*, Vol.38, Issue.5, May 2018, DESIDOC, Delhi, 2018, p.4.

[37] *Ibid*., p.6.

[38] Bhushan, Gopal (ed.), *DRDO NL*, Anniversary Issue 2016, DESIDOC, Delhi, 2016, p.26.

[39] Suri Alka (ed.), *Op.cit*., Vol.38, Issue.5, p.18.

[40] Suri Alka (ed.), *Op.cit*., Vol.38, Issue.3, p.8.

[41] Suri Alka (ed.), *DRDO NL,* Vol.38, Issue.8, August 2018, DESIDOC, Delhi, pp.19-21.

[42] Suri Alka (ed.), *DRDO NL*, Vol.38, Issue.2, Feb 2018, DESIDOC,Delhi,p.25

[43] BEL, *AR 2017-18*, Bengaluru, 2018, pp.12-13.