

ARAI

Progress through Research



Journey Towards
Green Future

47th ANNUAL REPORT

2016-2017

The Automotive Research Association of India

ARAI Vision and Mission



Vision

ARAI has a strong base of state-of-the-art technology equipment, laboratory facilities and highly qualified and experienced personnel. With these assets, ARAI has goals, strategies and action plans to achieve the fullest customer satisfaction. These are:-

- (a) to compete in service with excellence
- (b) to obtain recognition and accreditation
- (c) to cover global market
- (d) to build commitment of all personnel
- (e) to develop team spirit and sense of belonging amongst all.

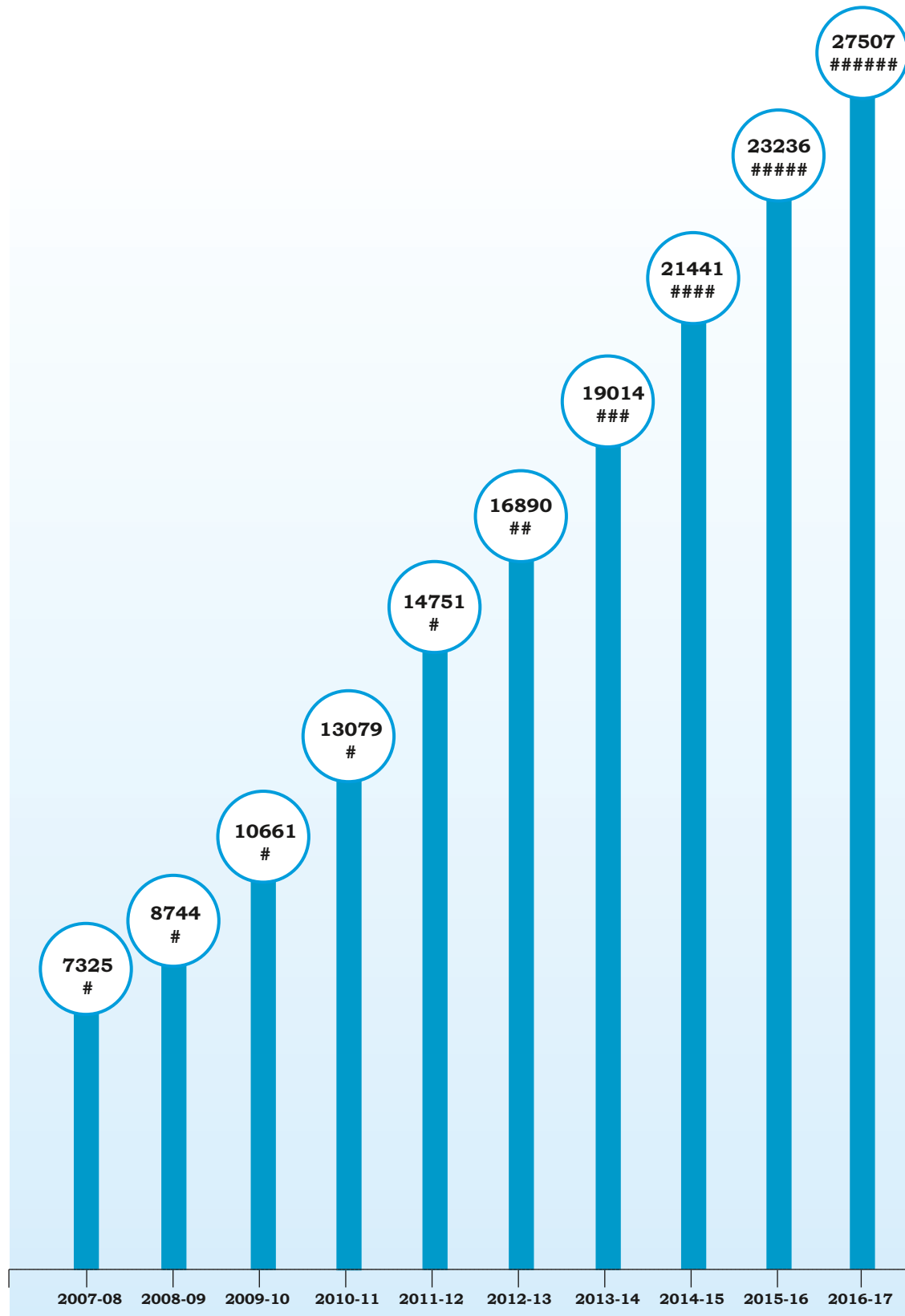


Mission

- ARAI has been providing various services to the Indian Automotive Industry, in the areas of design & development and know-how for manufacture & testing of components / system to national / international standards. ARAI shall strive to achieve international recognition in these areas.
- ARAI shall seek valuable guidance and support from members, from time to time to achieve growth and stability.
- With the globalisation of economy and business, ARAI shall enlarge its scope of services to meet the requirements of automotive industries worldwide.
- ARAI strongly believes that satisfaction of customer needs on continual basis, is of prime importance to earn loyalty of customers. Therefore, emphasis shall be on meeting and exceeding the customer needs through continuing quality improvement with active participation of employees and also customers.

TOTAL INCOME

(Rs. in lakh)



Excluding Interest on earmarked fund transferred to respective fund and funds transferred from R & D reserve fund.

Excluding Interest on earmarked fund transferred to respective fund Rs. 2353 lakhs and fund transferred from R & D reserve fund Rs. 48 Lakhs.

Excluding Interest on earmarked fund transferred to respective fund Rs. 2774 lakhs and fund transferred from R & D reserve fund Rs. 34 Lakhs.

Excluding Interest on earmarked fund transferred to respective fund Rs. 2253 lakhs and fund transferred from R & D reserve fund Rs. 81 Lakhs.

Excluding Interest on earmarked fund transferred to respective fund Rs. 2498 lakhs and fund transferred from R & D reserve fund Rs. 65 Lakhs.

Excluding Interest on earmarked fund transferred to respective fund Rs. 1407 lakhs and fund transferred from R & D reserve fund Rs. 66 Lakhs.

Highlights of the Year

- 16.6% growth in Operational Income over last year
- Recognized with 'Golden Peacock Environment Management Award', 'Corporate Award' and 'Best CSR Practices Award'
- Celebration of Golden Jubilee Year
- Release of 'ARAI Golden Jubilee Souvenir' and '50 Years of ARAI Publications' to commemorate Golden Jubilee of ARAI
- Accreditation of Pedestrian Safety Facility by VCA
- Design of Vehicle Capsule for defense application
- Demonstration of 'Dual-Fuel (Diesel + CNG) Engine for Off-road Applications', 'Automated Vehicle' (as part of project on Development of Autonomous Vehicle) and 'Pilot Electric Vehicle using indigenous Lithium ion Battery'
- Successful organization of SIAT 2017 and SIAT EXPO 2017



Golden Peacock Environment Management Award



Corporate Award by SAEINDIA Foundation



Best CSR Practices

Contents

| | |
|---|----------------|
| • Governing Council Members | 2 |
| • Members | 3 |
| • Committees | 4 |
| • President's Statement | 5 - 6 |
| • Director's Report | 7 - 10 |
| • Overview of Operations | 11 - 34 |
| • Development and Testing Activities | (12-15) |
| • Human Resource Development | (16-17) |
| • Corporate Social Responsibility (CSR) | (18) |
| • Technology / Research Publications | (19-21) |
| • Business Development | (22-24) |
| • Events | (25 - 29) |
| • Knowledge Centre | (30 - 33) |
| • ARAI - Homologation and Technology Centre (ARAI - HTC), Chakan | (34) |
| • Auditors' Report & Annual Statement of Accounts | 35 - 57 |
| • Independent Auditors' Report | (36) |
| • Annual Statement of Accounts | (37 - 57) |

Governing Council Members

| | |
|-----------------------|---|
| President | : Mr. Rajan Wadhera, President –Automotive Sector, Mahindra & Mahindra Ltd. |
| Vice President | : Mr. Vikram Kirloskar, Vice Chairman, Toyota Kirloskar Motor Pvt. Ltd. |
| Director | : Mrs. Rashmi Urdhwareshe |

Members

- | | | |
|---------------------------------------|---------------------------------|------------------------------------|
| 1. Ashok Leyland Ltd | 9. General Motors India Pvt Ltd | 17. Simpson & Co. Ltd |
| 2. Bajaj Auto Ltd | 10. Honda Cars India Ltd | 18. Tata Motors Ltd |
| 3. Bosch Ltd | 11. Hyundai Motor India Ltd | 19. Toyota Kirloskar Motor Pvt Ltd |
| 4. Cummins India Ltd | 12. JCBL Ltd. | 20. Tractor and Farm Equipment Ltd |
| 5. Cummins Technologies India Pvt Ltd | 13. Kirloskar Oil Engines Ltd | 21. TVS Motor Co. Ltd |
| 6. Eicher Motors Ltd | 14. Mahindra & Mahindra Ltd | 22. VE Commercial Vehicles Ltd |
| 7. Fiat India Automobiles Pvt Ltd | 15. Maruti Suzuki India Ltd | 23. Volkswagen India Pvt Ltd |
| 8. Force Motors Ltd | 16. Piaggio Vehicles Pvt Ltd | 24. Wheels India Ltd |

Govt. of India Representatives

Dr. Subhash Chandra Pandey
Additional Secretary & Financial Adviser,
Govt of India
Ministry of Heavy Industries & Public Enterprises
Department of Heavy Industry
Udyog Bhavan, New Delhi 110 011

Mr. Vishvajit Sahay
Joint Secretary (Auto)
Govt of India
Ministry of Heavy Industries & Public Enterprises
Department of Heavy Industry
Udyog Bhavan, New Delhi 110 011

Mr. K. K. Tiwari
Industrial Adviser
Govt of India
Ministry of Heavy Industries & Public Enterprises
Department of Heavy Industry
Udyog Bhavan, New Delhi 110 011

Invitees

- Society of Indian Automobile Manufacturers
- Automotive Component Manufacturers Association of India
- Tractor Manufacturers Association
- National Automotive Testing and R&D Infrastructure Project

Secretary to the Governing Council

Mrs. Prajakta M. Dhere

Address

Survey No. 102, Vetal Hill
Off Paud Road, Kothrud
Pune 411 038, INDIA
Phone : +91-20-3023 1111, 3023 1101
Fax : +91-20-3023 1104
Email: director@araiindia.com

Bankers

Bank of Baroda
HDFC Bank Ltd.

Status of Institute

Registered under The Societies Registration Act,
XXI of 1860–Reg.No.BOM/133/66 GBBSD dated 10-12-1966
New Reg. No. Maha/2066/2016/Pune dated 13-12-2016
Registered under The Maharashtra Public Trust Act, 1950
Reg. No. F-48091/Pune dated 13-12-2016

Auditors

M/s. P. G. Bhagwat
Chartered Accountants
Head Office : Suites 101-102, 'Orchard',
Dr. Pai Marg, Baner,
Pune 411 045
Tel. Ph. 020-27290771 / 1772

Members

1. Adient India Private Ltd.
(formerly Johnson Controls Automotive Ltd.)
2. Ashok Leyland Ltd.
3. AMW Motors Ltd. ~
4. Atul Auto Ltd.
5. A.J. Auto Pvt. Ltd.
6. Bajaj Auto Ltd.
7. Behr-Hella Thermocontrol (India) Pvt. Ltd.
8. Bharat Forge Ltd.
9. Bharat Seats Ltd.
10. Bosch Limited
11. Brakes India Ltd.
12. Chemito Infotech Pvt. Ltd. *
13. Cummins India Ltd.
14. Cummins Technologies India Pvt. Ltd.
15. Delphi-TVS Diesel Systems Ltd.
16. DSK Motowheels Pvt. Ltd. *
17. Eicher Motors Ltd.
18. Eicher Polaris Pvt. Ltd. *
19. Enginetech Systems Pvt. Ltd.
20. Faurecia Automotive Seating India Pvt. Ltd. *
21. FCA India Automobiles Pvt. Ltd.
22. Fiat India Automobiles Pvt. Ltd.
23. Force Motors Ltd.
24. Ford India Pvt. Ltd.
25. F P Seating Systems Pvt. Ltd.
26. General Motors India Pvt. Ltd.
27. Greaves Cotton Ltd.
28. Hero Electric Vehicles Pvt Ltd.
29. Hindustan Motors Ltd. ~
30. Honda Cars India Ltd.
31. Hyundai Motor India Ltd.
32. International Cars and Motors Ltd.
33. JCBL Ltd.
34. Kanda Auto Pvt. Ltd.
35. Kirloskar Oil Engines Ltd.
36. KPIT Technologies Ltd.
37. KSS Abhishek Safety Systems Pvt. Ltd.
38. Lear Automotive India Pvt. Ltd.
39. Lombardini India Pvt. Ltd.
40. Madras Engineering Industries Pvt.Ltd.
41. Mahindra Gujarat Tractor Ltd.
42. Mahindra & Mahindra Ltd.
43. Mahindra Heavy Engines Ltd.
44. Mahindra Electric Mobility Ltd.
(formerly Mahindra Reva Electric Vehicles Pvt. Ltd.)
45. MM Auto Industries Ltd. ~
46. Man Trucks India Pvt. Ltd.
47. Mansons International Pvt. Ltd.
48. Maruti Suzuki India Ltd.
49. Mercedes-Benz India Pvt. Ltd.
50. MSKH Seating Systems India (P) Ltd.
51. Piaggio Vehicles Pvt. Ltd.
52. P M Diesels Pvt. Ltd.
53. Power Electronics
54. Premier Ltd. ~
55. Randhawa Automobile Engineering Pvt. Ltd.
56. Rinder India Pvt. Ltd.
57. Rocket Engineering Corporation Pvt. Ltd.
58. Rohan BRC Gas Equipment Pvt. Ltd.
59. Rotary Electronics Pvt. Ltd.
60. Scooters India Ltd. ~
61. Simpson & Co. Ltd.
62. Skoda Auto India Pvt. Ltd.
63. S. M. Auto Engineering Pvt. Ltd.
64. SML Isuzu Ltd.
65. Spaco Technologies (India) Pvt. Ltd.
66. Sri Ramdas Motor Transport Ltd.
67. Tata Cummins Pvt. Ltd.
68. Tata Motors Ltd.
69. Toyota Kirloskar Motor Pvt. Ltd.
70. Tractors and Farm Equipment Ltd.
71. TVS Motor Co. Ltd.
72. Vanaz Engineers Ltd.
73. Varroc Lighting Systems (India) Pvt. Ltd.
74. VE Commercial Vehicles Ltd.
75. Virama Laminates Pvt. Ltd.
76. Volvo Group India Pvt. Ltd.
(formerly Volvo India Pvt. Ltd.)
77. Volkswagen India Pvt. Ltd.
78. WABCO India Ltd.
79. Wheels India Ltd.

* New membership

~ Withdrawal / Cancellation of membership

Committees

Finance & Internal Audit Committee (FIAC)

CHAIRMAN

Mr. Vikram Kirloskar

Chairman –FIAC, ARAI

Vice President - ARAI

Vice Chairman, Toyota Kirloskar Motor Pvt. Ltd.

MEMBERS

Mr. N. D. Pathak

Executive Chairman,
Spaco Technologies (India) Pvt. Ltd.

Mr. R. R. Deshpande

Jt. Managing Director,
Kirloskar Oil Engines Ltd.

Mr. Suhas Kadlaskar

Vice President
Corporate Affairs & Human Resources
Mercedes-Benz India Pvt. Ltd.

Mr. Venugopal P. Rao

Head (NPI-CVBU Business Planning),
Tata Motors Ltd.

Mr. Gajanan Chinchwadkar

Sr. General Manager - F&A
Mahindra & Mahindra Ltd.

Ms. Soma Ghosh

Finance Director -
India Technical Organisation,
Cummins Technologies India Pvt. Ltd.

Mr. Pankaj Gupta

Vice President-External Affairs & CSR,
Volkswagen India Pvt. Ltd.

Representative

Government of India,
Ministry of Heavy Industries & Public
Enterprises,
Department of Heavy Industry,
Udyog Bhavan,
New Delhi 110 011

Mrs. Rashmi Urdhwarsh

Director-ARAI

Mr. Atul Bhide

Deputy Director (Finance & Accounts)
Member Secretary

Project Evaluation & Monitoring Committee (PEMC)

CHAIRMAN

Mr. Jayanta Kumar Deb

Sr. Vice President, Head - Product Development (Automotive Sector),
Mahindra & Mahindra Ltd.

MEMBERS

Mr. Rajinder S. Sachdeva

Chief Operating Officer,
V E Commercial Vehicles Limited

Mr. I. V. Rao

Executive Advisor,
Maruti Suzuki India Ltd.

Mr. Brian McMurray

Director, Vehicle Integration
General Motors India Engineering

Mr. Michael Poznanski Eisenschmidt

Technical Head
Volkswagen India Pvt. Ltd.

Mr. Vinay Harne

President - NPD
TVS Motor Co. Ltd.

Alternate member

Mr. Y. Ramachandra Babu

Adviser - R&D,
TVS Motor Co. Ltd.

Mr. S. Janardhanan

Vice President (Co-ordination)
Simpson & Co. Ltd.

Mr. Ashok Yewale

Deputy Chief Technology Officer (R&D),
Force Motors Limited

Mr. R. Narasimhan

Vice President (R&D)
Bajaj Auto Ltd.

Dr. N. Saravanan

Head (Engineering)
Ashok Leyland Limited

Mr. T. R. Kesavan

Chief Operating Officer
Tractors and Farm Equipment Limited

Representative

Government of India,
Ministry of Heavy Industries & Public
Enterprises,
Department of Heavy Industry,
Udyog Bhavan, New Delhi 110 011

Mrs. Rashmi Urdhwarsh

Director-ARAI

Mr. N. B. Dhande

Sr. Deputy Director

Mr. Suyog Gadgil

Deputy Manager
Member Secretary

There is also a 'Sub-committee of PEMC' to review and monitor projects of ARAI - Forging Industry Division.



Mr. Rajan Wadhera
President - ARAI

President's Statement



Mr. Vikram Kirloskar
Vice President - ARAI

Dear Members,

It is a privilege to present our Annual Report for the Financial Year 2016-17, which was a milestone year, as ARAI completed 50 years. It has been a rewarding and satisfying journey that started with small, but determined steps in 1966. Today, we all are very proud of our achievements, which have made us a leading research, testing and certification institute for the automotive industry.

Journey of 50 Years

In our journey of 50-years, we have transcended several boundaries, including service and geographical boundaries. More importantly, we have transcended boundaries that go to the heart of our DNA. We have evolved from good managers to effective leaders, individual contributors to team players and finally from a testing institute to a research institute.

There have been many milestones since 1966, leading to the success and scale we have achieved today. These milestones are indicators of our remarkably consistent journey, thanks to the support of the stakeholders and the employees. We have developed a competitive advantage by focusing on our core competencies; providing value-added and differentiated solutions to our customers; expanding our reach to serve global customers; and developing a portfolio catering to our customers' needs.

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ARAI Performance

Our performance in 2016-17 has been phenomenal as our Operational Income grew by 16.6% year-on-year to reach Rs. 246 crore, with both certification and non-certification businesses contributing an equal share. I congratulate Director and Team ARAI for this exceptional performance, which in a way is like an icing on the cake in this milestone year. I thank Indian as well as global automotive fraternity for the continued trust and encouragement, which has given us energy, enthusiasm, confidence and motivation to strive for betterment.



Focus on technology absorption, adoption and innovation remains our central driver for ensuring sustainable growth for us in the future. In line with this focus, we are working on various research projects in the areas of light weighting, EV / HEV technologies and vehicle dynamics. The year has seen successful completion of Department of Heavy Industry (DHI) supported project on 'Development of Offline and Real-time Simulator for EV / HEV systems' and three internally funded projects. The completed internal projects were on building competencies in design & optimization of Steering, Chassis Frame and Air Suspension Systems. The competencies developed from these projects, have

contributed in expanding our service range. Coming to the ongoing projects, we are working on thirteen projects, which are in line with our identified areas under Technology Roadmap, i.e. light weighting and electric / hybrid electric vehicle technologies. Of these thirteen projects, nine are being implemented under the support of DHI and the remaining four are internally funded.

We believe innovation need not always mean new products. It also means changes in something that is established, i.e. introducing new methods, processes or ideas. These changes help in improving operational efficiencies

and optimizing capacity utilization, and thereby bring in competitive advantage. Hence, we are focusing on continual improvement in our processes and consolidating our strengths, both in technical as well as non-technical domains.

On the facilities front, our new centre, ARAI – Homologation and Technology Centre (ARAI – HTC), Chakan; established under National Automotive Testing and R&D Infrastructure Project (NATRiP), has started serving the customers. Also, the testing infrastructure for certification testing of electric and hybrid electric vehicles, being established here, under DHI's FAME-India initiative, will enlarge our service portfolio further.

With regard to projects on facilitating establishment of Inspection & Certification (I&C) Centre, we are working with six states under an initiative of Ministry of Road Transport & Highways (MoRTH). In addition to this, we have been awarded with contracts for facilitating establishment of another 5 I&C Centres by one of these states.

During the year, five Automotive Industry Standards (AIS) were released taking the total standards published till date to 178, covering wide range of subjects for different categories of motor vehicles.

Our Training Centre organized 58 Proficiency Improvement Programmes (PIPs) and 5 Domain Training Programmes (DTPs) for industry personnel during the year. Our Learning Centre continues to offer Ph. D., M. Tech, M. S. and B. Tech. programmes in various automotive disciplines under tie-ups with various national as well as international universities.

Focus on technology absorption, adoption and innovation remains our central driver for ensuring a sustainable growth for us in the future

We believe innovation need not always mean new products. It also means changes in something that is established, i.e. introducing new methods, processes or ideas.

Golden Jubilee Year Celebrations

As part of our golden jubilee year celebrations we had organized various events, which were primarily for recognizing young engineers, honouring eminent scientists and creating road safety awareness amongst common people. Also, for the benefit of employees, lectures by eminent personalities and sporting events were organized. On the occasion of the golden jubilee, we have also released 'ARAI Golden Jubilee Souvenir' (a Coffee Table Book), which has exquisitely captured our journey of 50 glorious years.

SIAT 2017

'Symposium on International Automotive Technology' SIAT 2017 was organized successfully in association with SAEINDIA, NATRiP and SAE International (USA). The focus of the presentations at this symposium was on recent advancements in automotive technology in areas like Safety, Emissions, Engines, Electric Mobility, Electronics, Intelligent Transportation, etc. SIAT EXPO 2017 held concurrently provided an opportunity to the participating organizations to showcase their latest automotive technologies, products and services. Also, SIAT 2017 was a grand finale of our Golden Jubilee Year Celebrations.

Looking Ahead

Looking forward, we will continue to build on our strengths and invest our resources for creating more value for our customers. At the same time, we will challenge ourselves to aim higher, go further and achieve more.

I take this opportunity to thank the Vice President & Members of the Governing Council; Department of Heavy Industry (DHI); the Chairman and Members of Project Evaluation and Monitoring Committee; the Chairman and Members of Finance and Internal Audit Committee; and ARAI Members for their valuable support. I am sure, with your continued support we will race ahead with the same energy and positivity to build a vibrant future for all of us.

Looking forward, we will continue to build on our strengths and invest our resources for creating more value for the customers. At the same time, we will challenge ourselves to aim higher, go further and achieve more.

Rajan Wadhwa



Mrs. Rashmi Urdhwareshe
Director

Director's Report

The Governing Council of ARAI has great pleasure in presenting the Annual Report, along with Audited Statement of Accounts for the year ending 31st March 2017.

2016-17 was a memorable year for all of us as ARAI completed its 50 years. It has been an incredible journey of 50 years, as we have evolved and transcended from our humble beginnings to a renowned certification and research institute today. Over these years, we have continuously demonstrated our ability to capitalize quickly and decisively as per the market requirements. We have the right people, right portfolio and right strategy to ensure long-term success.

I write my statement with pride, as I have been a major part of this transformational journey. I believe a memorable occasion like this is always a time, to both rejoice and reflect, to re-commit and re-dedicate.

This year we have seen significant growth of 16.6% in our Operational Income. Throughout the past, certification segment has been our forte. This year too, this segment contributed about 50% of Operational Income, with the remaining coming from non-certification segment. Besides this, we have been recognized with 'Golden Peacock Environment Management Award', 'Corporate Award' and 'Best CSR Practices Award'. Another noteworthy aspect of this year has been the outcome of employees' satisfaction survey, which was carried out through an external agency. This survey revealed that 98% of the employees are satisfied with their job and are happy to work for this organization, which indeed is very encouraging.

It has been an incredible journey of 50 years, as we have evolved and transcended from our humble beginnings to a renowned certification and research institute today.

We are constantly learning and sharing knowledge across all of our domains. Our Technology Roadmap projects are good examples, wherein we have cross-functional teams working on various projects in the areas of light weighting and electric / hybrid electric vehicle technologies.

We are constantly learning and sharing knowledge across all of our domains. Our Technology Roadmap projects are good examples, wherein we have cross-functional teams working on various projects in the areas of light weighting and electric / hybrid electric vehicle technologies. Complementing these cross-functional teams are collaborative research projects like the one being executed with Vikram Sarabhai Space Centre, ISRO, for battery development. These approaches have fostered creativity and collaborative working throughout the organization. Also, we are working on other research projects, which I am sure, will build new competencies and help in meeting the future requirements of our customers. Also, our capacities have been

further strengthened with facilities at ARAI – Homologation & Technology Centre (ARAI – HTC) becoming operational and delivering new business.

For us at ARAI, all our customers, collaborators and employees are our partners. This approach has yielded good returns for all the stakeholders. Our customers have always supported and guided us in all our ventures and have been our guiding force since beginning. We would continue creating value for all our customers and would like to thank them for their continuous support extended through these years and look forward to take these valued relationships to the

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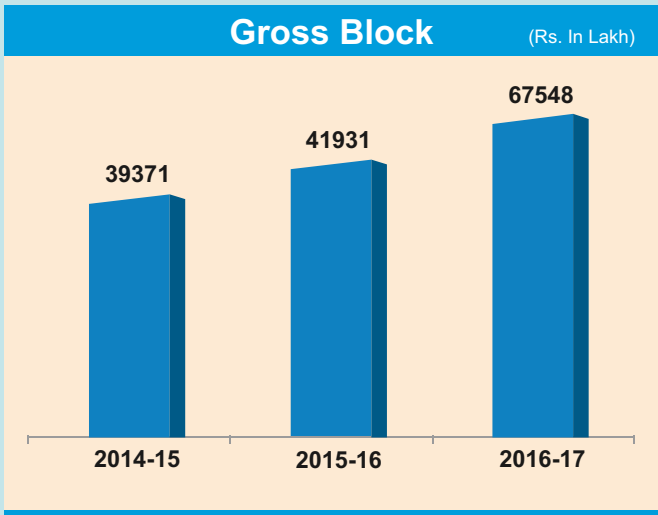
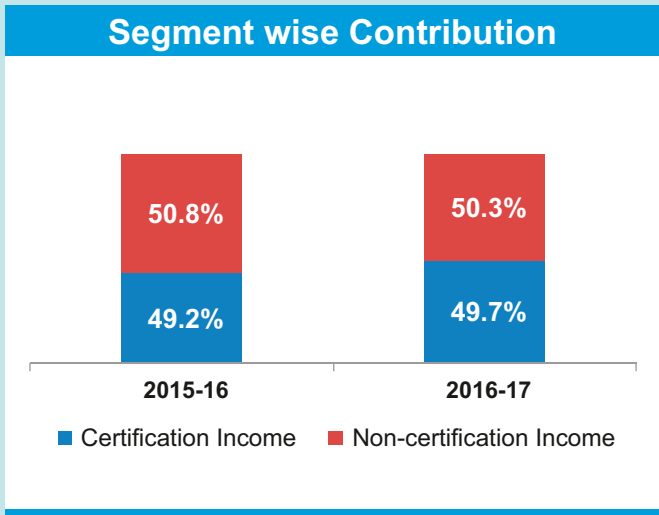
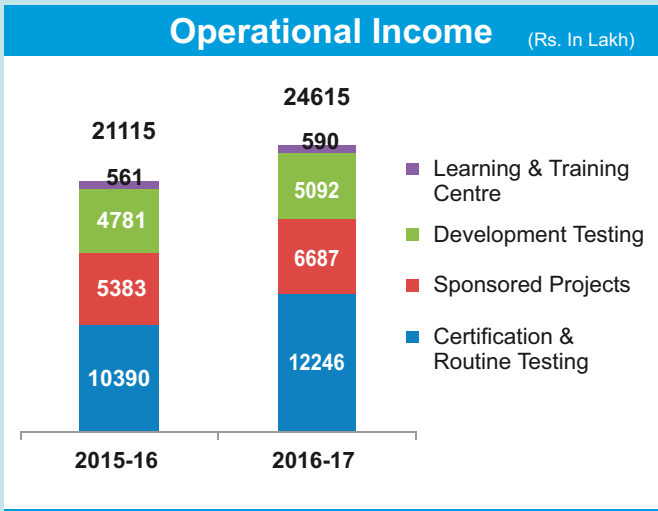
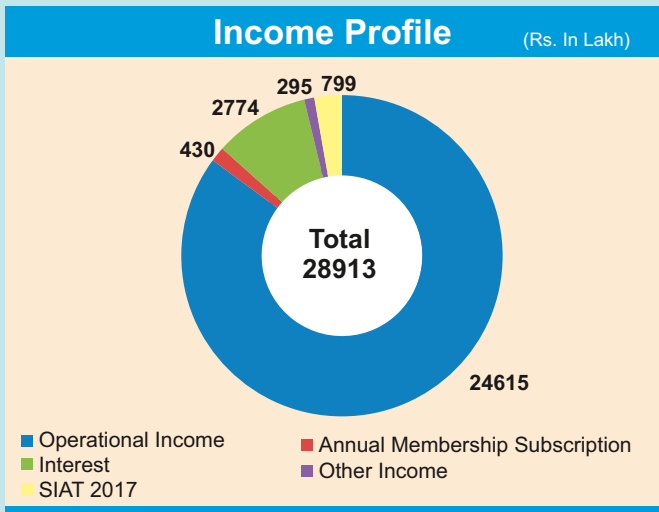
I am confident, our time-tested commitment to our values, underpins our ability to deliver long-term growth.

next level. I am confident, our time-tested commitment to our values, underpins our ability to deliver long-term growth.

On behalf of Team ARAI, I would like to thank the President, Vice President, Members of the Governing Council, ARAI Members, Members of Finance & Internal Audit Committee, Members of Project Evaluation & Monitoring Committee and Senior Officials from the Department of Heavy Industry (DHI) for their valuable contribution and guidance.

Mrs. Rashmi Urdhwareshe

Key Indicators : 2016-17



Operational Highlights

Finance & Accounts

The Income & Expenditure Account, Balance Sheet and Auditor's Report are presented herewith.

- **Financial performance**

ARAI has continued to show excellent performance during the Financial Year 2016-17. The Income Target has been achieved and Operational Income has gone up by 16.58% to Rs. 24614.67 lakh as compared to Rs. 21114.65 lakh in 2015-16. The Total Income, including membership subscription, interest, etc. has reached a figure of Rs. 28913 lakh (excluding funds transferred from R&D reserve fund) as compared to Rs. 25735 lakh of last year. This is the result of several measures undertaken in overall ARAI governance, in areas such as finance, purchase, invoicing procedure, time management, productivity improvement, competence building and Human Resource Development, etc.

- **Investment of funds**

The cash assets available with ARAI have been invested in Scheduled Banks / Financial Institutions in various Deposit Schemes as per Government guidelines and Savings Bank Accounts.

- **DHI Supported Projects**

Projects approved by the Cess Committee are funded by Department of Heavy Industry (DHI), Ministry of Heavy Industries & Public Enterprises (MHI&PE), Government of India; out of Automobile Cess funds and projects approved by DHI's Project Implementation and Sanctioning Committee (PISC) under FAME-India Scheme are Plan Projects. ARAI has also taken up R&D projects funded from its internal funds.

- **Appointment of Statutory Auditors**

M/s P. G. Bhagwat, Chartered Accountants, Pune, were appointed as Statutory Auditors for the Financial Year 2016-2017, in the Annual General Meeting held on 31st August 2016.

- **Membership Subscription**

The total number of members of ARAI as on 31st March 2017 is 75 and the Annual Membership Subscription for the year under report is Rs. 430.48 lakh.

- **Recognition by DSIR**

The Department of Scientific & Industrial Research, Ministry of Science & Technology, Govt of India, has renewed recognition to ARAI, as a Scientific and Industrial Research Organisation (SIRO), for further period from April 2017 to March 2020.

- **Credit rating**

The rating on the bank facilities of ARAI has been reaffirmed at CRISIL A1 + (which corresponds to very strong degree of safety regarding timely payment of financial obligations).

- **Income tax**

The Central Board of Direct Taxes has approved ARAI for exemption purposes under Sec. 35 (1) (ii) of the Income Tax Act, 1961, vide Notification No. 9/2007 (F.NO. 203/18/2005-ITA-II) dated 28-3-2007 effective 1-4-2004.

Research Projects

During the year, a consortium project, supported by DHI was successfully completed. The consortia partners of this project were ARAI; CDAC, Thiruvananthapuram; IITB, Mumbai; and IISc, Bengaluru. Under this project offline and real-time simulators for EV / HEV applications and training modules for academia have been developed. Besides this project, three internally funded projects were also completed. They were on building competencies in design & optimization of Steering, Chassis Frame and Air Suspension Systems. Under these projects, prototypes of EPAS and Air Suspension System have been developed. All these projects have helped in enhancing capabilities and technical know-how and in turn widened our service portfolio. In case of ongoing research projects, currently nine projects are being implemented under DHI's support and four under internal funding.



Prototype of Real-time Simulator



EPAS Prototype

Model Inspection & Certification (I&C) Test Centres

ARAI has been identified by Ministry of Road Transport & Highways (MoRTH), for facilitating establishment of model test centres for inspection and certification of in-use vehicles. Under this program initiated by MoRTH, ARAI has already facilitated establishment of Nasik Test Centre in Maharashtra. In addition to this centre, ARAI is currently facilitating establishment of such centres in another six states and three more centres for a State Transport Department. Apart from this, ARAI has been awarded with contracts for five more centres by one of these states.

Golden Jubilee Year Celebrations

ARAI celebrated its Golden Jubilee – signifying 50 years of strength, perseverance and endurance that has made it what it is today. Various programmes organized to commemorate the golden jubilee included Scientist Meet, Lecture Series by eminent personalities, Young Engineer award competition, Short Film making contest on Road Safety Awareness, exhibition of Automotive Safety Cartoons, Inter-Departmental Sporting events for employees. Also, ARAI Golden Jubilee Souvenir (Coffee Table Book capturing significant achievements of 50 years) and 50 Years of ARAI Publications were released as a part of the golden Jubilee year celebrations. These year-long celebrations culminated during SIAT 2017.

ARAI Homologation and Technology Centre (ARAI – HTC), Chakan

ARAI Homologation and Technology Centre at Chakan has commenced its operations with customer centric approach. The three labs at this centre, i.e. Passive Safety Laboratory, Fatigue Laboratory and Powertrain Laboratory; have executed various projects for the customers. During the year, many delegations from various OEMs visited ARAI- HTC and appreciated the competency, capability and facilities available at this centre.

Business Development Initiatives

- CEO / CTO Meet at Chennai
- Customer Meets at ARAI, ARAI – HTC and Chennai
- Capabilities in design, development, testing and certification of automobiles & automotive components showcased at domestic and international exhibitions / seminars
- Tech Pavilion set up at SIAT 2017 to display certification and technological capabilities

- Introduction of various new services / processes / methodologies, like certification of vehicle alarm systems as per AIS-076, consultancy for AIS-052, crash testing of passenger cars as per various NCAP protocols, road vehicle interaction analysis tool kit, BSR subjective & objective evaluation, performance evaluation of battery operated locomotive, noise measurement on mining machines, etc.
- MoU with Cognizant Technology Solutions (CTS) for development of an autonomous vehicle
- Collaboration with BWF-Esslingen, Steinbeis-Transferzentrum, Bauteilfestigkeit und-sicherheit, Werkstoff-und Fügetechnik (BWF), Germany in the field of Metallurgical Failure Analysis studies
- MoU with Christ University, Bengaluru for commencement of 4-Year B. Tech Programme in Automobile Engineering
- Renewal of MoU with VIT University, Vellore for regular M. Tech & B. Tech ongoing programmes
- Collaboration with UTAC CERAM, France, for mutual sharing of technology and assistance in automotive testing

Systems Compliance and Quality Management

- Successful completion of Surveillance Audits: ISO 9001, ISO 14001 and OHSAS 18001 of ARAI, Pune and ARAI-FID, Chakan
- Successful completion of BIS Re-certification audit for Safety Glass & Tyres scopes
- On-site Assessment of 4 fields of Calibration and 4 fields of Testing in accordance with ISO/IEC 17025:2005 successfully completed during NABL audit
- Completion of ISO 9001, ISO 14001, OHSAS 18001, NABL & BIS internal audits
- Implementation of SAP in process

Corporate Social Responsibility (CSR)

ARAI's voluntary CSR initiative has been recognized with "Best CSR Practices" award by Maharshi Karve Stree Shikshan Sanstha's Smt. Hiraben Nanawati Institute of Management & Research for Women (Powered by Rotary Club & Odser Charitable Trust). Taking the CSR initiative further, this year ARAI has supported eight projects in the areas of Education, Health, Community Development and Swachh Bharat Abhiyan.

- Development and Testing Activities

- Human Resource Development

- Corporate Social Responsibility (CSR)

- Technology / Research Publications

- Business Development

- Events

- Knowledge Centre

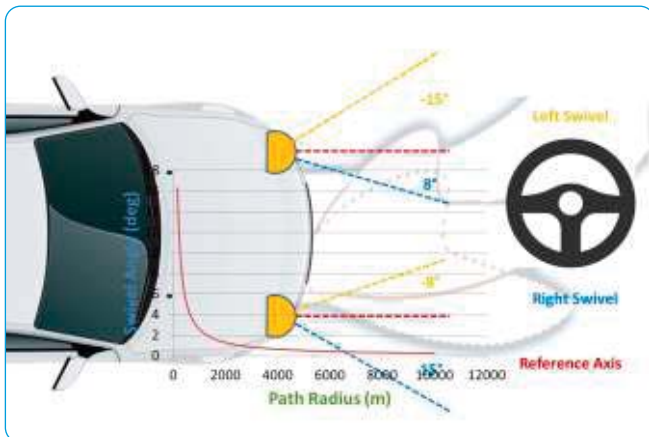
- ARAI Homologation and Technology Centre (ARAI - HTC), Chakan

Development and Testing Activities

ARAI undertakes research, developmental, testing and certification projects for the automotive industry. Some of the projects in design, development, validation and evaluation areas undertaken during 2016-17 are given below.

- Control Strategy for Adaptive Front Lighting System

Control strategy for Adaptive Front Lighting (AFS) with simulation tools and open ECU environment has been developed, validated and demonstrated on a vehicle. The customers' requirements were captured & translated to functional architecture and V-Model methodology was deployed in this project. It involved benchmarking study, development of control strategy for AFS, proof of concept, prototype development, vehicle level integration, validation in lab & on vehicle and calibration of different modes. The key features of AFS considered in this internally funded project were country mode, town mode, expressway mode, weather mode and dynamic swiveling.



- Offline and Real-time Simulator for EV / HEV Systems

ARAI has successfully developed an Offline Simulator and a Real-time Simulator for EV / HEV systems under a consortium project supported by Department of Heavy Industry (DHI), Government of India. CDAC, Thiruvananthapuram; IITB, Mumbai; and IISc, Bengaluru were the consortium partners in this project. The developed Offline Simulator has been benchmarked (against internationally available offline simulators), evaluated and validated. Further, its beta version has been released for use and for continual evaluation amongst consortium partners. Also, 4

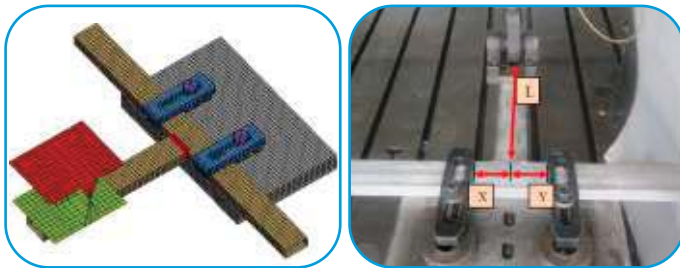
prototypes of Real-time Simulator have been developed, integrated and installed at ARAI and CDAC. The other outcome of this project has been development of training material and experimental kits for extending the knowledge base to academic institutes and industry.



Prototype of Real-time Simulator

- Technology for Joining and Compatibility of Aluminium with Steel and Plastic

This successfully executed consortium project on MULTIJOIN Technology was supported by Technology Development Board (TDB), Department of Science & Technology. The lead agency of this consortium project was International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad. The other partners included ARAI; IIT-M, Chennai; IISc, Bengaluru; Ashok Leyland (industry partner); and four institutes of Fraunhofer, Germany. In this project, ARAI has successfully developed joining technology and this development process involved designing lab scale specimen test method, characterizing lab specimen level joints, simulation and correlation of joints and assemblies for micro as well as macro level. While executing the project, joining technologies like thermal joining technology – CMT, laser brazing, mechanical joining technology – Clinch, SPR and adhesive joining were explored.



Bus Waist Rail Joint Assembly Simulation and Correlation

- Up gradation of Tractor Diesel Engines to meet Stage-III A Emission Norms

This project, for an overseas tractor manufacturer, involves design and development of family of tractor engines from clean sheet, proto-type component development, proto engine assembly and proving of performance & emission compliance to the specified engineering targets. The first engine family has a rating of 3-cylinder 50 hp engine. The second family consists of three ratings, viz. 4 cylinder 75 hp, 68 hp and 60 hp tractor engines. Proto components development activity was carried out with various suppliers. Validation tests of various components / subsystems on rig level and engine basis were also carried out. The engines have been optimized for Stage II A emission norms and demonstrated to customer. Currently, these newly designed and developed engines of above ratings are in pre-production phase.



- Air Suspension System for Target Vehicle

This project was on design conceptualization of Air Suspension System, mathematical software tool kit & training module development and competency development. Under this project, two concepts of Air Suspension System have been designed. One of the concepts was an Air spring fitted over existing suspension of the vehicle and other was air spring fitted by removing existing suspension configuration. These concepts were evaluated in CAD environment for size & packaging requirements and to find necessary modifications or changes to be incorporated in vehicle. Virtual MBD analysis was also performed to evaluate suspension configuration in virtual environment through replicating real life scenarios such as different track runs, four poster ride events etc. A proto of the first concept was fabricated and assembled on vehicle, which mainly consisted of air spring, control switches, compressor and solenoid valves. It facilitates different pressure settings through dashboard mounted switches, which can help to get variation of stiffness in air spring and to maintain ride height during loading scenarios, thus improving some aspects of handling and ride.



Developed Concepts of Air Suspension System

- Lightweight Forging Process for automotive components

This project, supported by DHI, is on developing Lightweight Forging process for automotive components. The methodology of this project includes optimization of forging process with emphasis on light weighting & energy saving, creation of databank of forged components, adoption of inverse analysis approach for developing lightweight design and validation of developed forging process by simulation and experiments. The outcome achieved under this project includes process parameter design for aluminium alloys; forging & characterization of

Ploughshare & evaluation; forging & fatigue life testing of forged micro-alloyed steel connecting rod; and development of methodology for mathematical tool.



Forged Ploughshare



Lightweight Aluminium Connecting Rod

- Verification and Validation Projects
 - CMVR Type Approval cases
 - About 30 vehicles evaluated as per FAME guidelines. This evaluation includes performance parameters like energy consumption, range in electric drive mode, fuel economy in case of hybrid vehicles etc.
 - Generator Sets for Noise Compliance
 - Design Validation for Seat Manufacturers
 - Validation trials for endurance running in of Passenger Cars, SUVs and Tractor-Trailers
 - ABS Evaluation for L2 (Two Wheeler), M3 (Buses) and N3 (Trucks) & Trailers
 - Accreditation of Test Tracks
 - Tyre Testing

- Structural Strength Evaluation

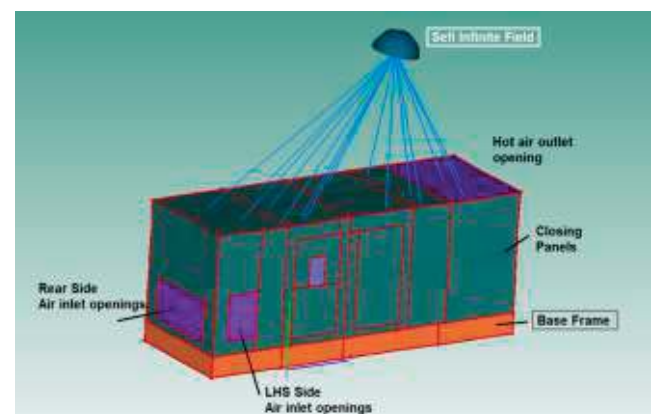
ARAI has successfully evaluated structural strength performance of Articulated Bus (18 m length) which comprises of Driver Unit, Articulation Mechanism and Driven Unit. In this exercise, the challenge was in capturing physical behaviour of articulated mechanism during rollover. Strength of bus superstructure in terms of rollover from ground and durability loads, viz. Static GVW, Single wheel on bump, Front & Rear wheel on bump, opposite wheel on bump, braking, vibration and buckling were evaluated as per requirements mentioned in UBS-II.



Structural Strength Evaluation of Articulated Bus

- Enclosure Noise Reduction

This project was on reducing noise levels of a high capacity Diesel Generator to meet CPCB norms with compact size. This involved building of vibro-acoustic model of the DG Set using Statistical Energy Analysis based technique (SEA). The noise sources, including the engine, alternator, fan and exhaust were characterized experimentally. The vibro-acoustic performance of the enclosure and sound suppression features were modelled through BIOT parameters and experimentally validated. The experimental and simulated results achieved were within 0.5 dB for overall levels. Further, optimization was carried out considering parameters like noise path modifications (ducts, partitions), leakages, louvers and absorbing material selection. The outcome of the project was an overall noise reduction of 8 dB without affecting cooling performance of DG set.



- Durability on Four Poster and BSR Subjective Evaluation

Under this project, Four Poster durability in Climatic Chamber and BSR Subjective evaluation has been carried out. The test facility was certified by representative from France. This project involved laboratory simulation of roads & tracks for durability evaluation & BSR Synthetic track for BSR evaluation and environmental simulation for temperature, humidity & solar simulation.



Four Poster Durability in Climatic Chamber and BSR Subjective Evaluation

- Crash Tests as per various Protocols

An ongoing project for an overseas customer is on conducting series of crash tests on a Passenger Car as per various NCAP protocols. These tests, being conducted at ARAI's HTC facility, aim at Airbag ECU validation, NCAP performance verification, Export Homologation etc. Also, numerous tests have been conducted for various customers as per draft Bharat NCAP and Latin NCAP protocols.

- Evaluation of Transmission, Rear Axle and Engine Oil

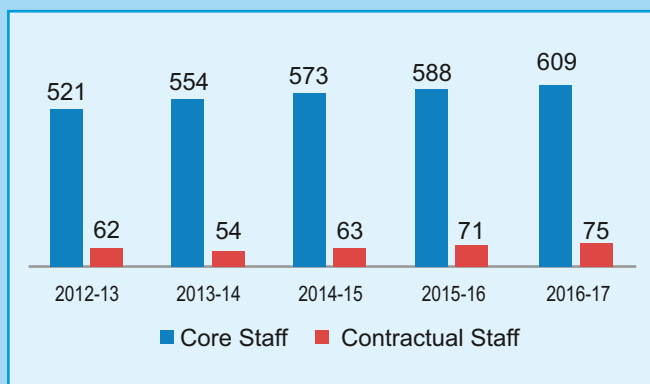
This project was on conducting fuel economy tests on HCV vehicle as per customer developed driving cycle for different transmission and rear axle oils provided by the customer. These fuel consumption trials were conducted using fuel consumption meter, commercial BS-IV diesel and customer recommended flushing procedure. The vehicle was instrumented with various sensors for continuous recording of parameters like speed, force, power, engine oil temperature, fuel quantity etc. Laden and unladen cycles up to 31000 Kg. was used in this project and total of 58 tests were carried out to evaluate the better oils among given samples.

Human Resource Development

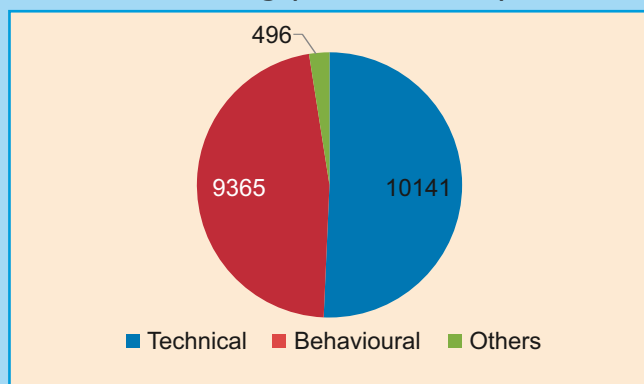
A highly engaged and motivated employee-base along with adequate leadership, technical knowledge and business skills remain the most attractive part of an organization. We at ARAI realize the importance of both – our people and their potential to contribute to our success. While our services and customers will continue to be important enablers in stepping up the speed at which we will grow, our people can be catalysts to our high growth agenda.

Our human resource strength at the end of 2016-17 was 684, including the contractual staff. To enhance the skill sets of our employees, we had organized over 20000 man-hours of training in technical, behavioural and other areas during 2016-17.

Manpower (in numbers)



Training (in Man-hours)



Happiness Index Survey

ARAI had engaged the services of a leading B School for carrying out 'Employees Satisfaction Survey.' This Survey was conducted at ARAI Pune during March 2016 to July 2016. The various parameters, studied as part of this survey, were communication, satisfaction, training, career, institute, appraisal, recognition, management, department, teamwork, respect, equality and security.

The survey revealed that 98% of the employees working are satisfied with their job and are happy to work for this organization. The Happiness Index calculated was based on factors of career development opportunities, openness of communication system & appraisal system, learning & development opportunities, rewards & recognition policy, equal treatment of employees and job security. This high score of Happiness Index is an indicator that ARAI as an organization, is committed to work on its vision statement of 'Building commitment of all personnel' and 'Developing team spirit and sense of belonging amongst all'. Further, over 97% of the employees opined that they were willing to recommend ARAI to their friends and family members as an institute to work for. The outcome of this survey validates the excellent growth, learning and development opportunities available at ARAI. Also, it is an indicator of the loyalty of the employees towards the institute.

ADMINISTRATIVE ACTIVITIES

• Annual Day

ARAI celebrated its Annual Day on 10th December 2016. This was indeed an exceptional day as it marked completion of ARAI's 50 years. On this occasion cultural programme was organized, wherein various employees showcased their talents. This cultural programme was followed with presentation of following awards at the hands of Director.

- ARAI Model Employee for the Year 2016
- ARAI Departmental Model Employee for the Year 2016
- Merit Awards to the children of ARAI Employees
- Special Recognition Award – 2016 for Achievement / Innovative Ideas / Contribution
- Recognition Award for 25 years' of service in ARAI
- Welfare Awards
- Best Executive (3 awards) for the year 2016

• Other Activities:

- Independence Day and Republic Day Celebrations
- National Safety Week was observed during 4th to 11th March 2017
- Organizing of Blood Donation camp



Annual Day Celebrations

Independence Day Celebration



Republic Day Celebration

Blood Donation Camp



Corporate Social Responsibility (CSR)

ARAI had taken up Corporate Social Responsibility (CSR) initiative voluntarily in 2008. Activities under this initiative are carried out by ARAI's Social Responsibility Support Group (SRSB). This initiative has been recognized with "Best CSR Practices" award by Maharshi Karve Stree Shikshan Sanstha's Smt. Hiraben Nanawati Institute of Management & Research for Women '(Powered by Rotary Club & Odser Charitable Trust)'.

This year ARAI supported following eight projects in the areas of Education, Health, Community Development and Swachh Bharat Abhiyan.

EDUCATION:

- Benches for an orphanage schools, "Pratik Vidya Niketan" and "Chhatrapati Shivaji Madhyamik Vidyalay".
- Financial assistance to 'Vidnyanvahini', a Pune based NGO, for procurement of science lab material. This NGO visits schools situated in remote areas of various states to provide the students with laboratory facilities.
- Financial assistance for procurement of CCTV Camera, Amplifire, Sound System, Cupboards to "Shree Sai Seva Sanstha, Pune", which works for mentally challenged children in the fields of education, food and shelter.
- Brailer machines, lockers and water purifier for "Ved Vasudev Pratishtan", an NGO working for blind students in the areas of education, food and shelter.
- Assistance to "Rotary Club of Poona (West)" for

their school infrastructure projects in remote areas of Pune district. These projects are to enhance quality of education and reach out to poor and marginalized children.

HEALTH:

- Support for procurement of Portable PA System and LCD Projector to "Mukta Charitable Foundation", an organization playing a vital role of educating people about HIV/AIDS, TB, Hepatitis B, Oral Cancer and other diseases.

COMMUNITY DEVELOPMENT:

- Assistance to "Hockey Association of Chota Nagpur Tribal" (New Delhi) for their Hockey tournaments, which are conducted every year for the tribal people.

SWACHH BHARAT ABHIYAN:

- To motivate people for maintaining the "Environment", ARAI has taken up an environment related project under 'Swachh Bharat Abhiyan'. Under this project sanitary napkins disposer machine is being installed in Pune with the help of NGO "Sevavardhini Sanstha" and "Pune Municipal Corporation".



Best CSR Practices Award

SRSB Team



Technology / Research Publications

- 'Design and Validation of Crash Rated Bollard as per SD-STD-02.01 Rev. A using Finite Element Analysis' by S. R. Deshpande, S. E. Chopade & N.V. Karanth of ARAI and Major Mittra of Swaraj Secutech in June 2016 at NAFEMS Americas Conference 2016, Seattle, USA
- 'Design and Validation of Crash Rated Bollard as per SD-STD-02.01 Rev. A using LS-Dyna' by S. R. Deshpande, S. E. Chopade & N. V. Karanth of ARAI and Major Mittra of Swaraj Secutech in June 2016 at 14th International LS-DYNA Conference, Detroit, USA
- 'Study of Void Formation during Solidification of Organic Material and Pure Metal in Cylindrical Shells' by Kishor Udawant in August 2016 at NAFEMS India Conference-NAFEMS 3D, Bangalore
- 'Control Strategy Development For Gasoline Direct Injection (GDI) and Performance Evaluation on HIL Platform' by Ravindra Shah in September 2016 at FISITA 2016 World Automotive Congress, Busan, South Korea
- 'Innovation In Teaching Learning Methods' by Dr. K. C. Vora & Aatmesh Jain in September 2016 at FISITA 2016 World Automotive Congress, Busan, South Korea
- 'Tubular Components in Automobile: Advanced Evaluation Techniques' by P. B. Deshmukh & P. S. Phale in October 2016 at Symposium on Innovative Solutions for Global Competitiveness in tube and pipe manufacturing, Mumbai
- 'Integrated computational materials modelling of 38MnVS6 and 42CrMo4 forging process' by P. K. Ajeet Babu & Venkat in November 2016 at NMD Conference, Kanpur
- '40 Years' Service of ARAI Library: A Look Back and its Future Activities towards Digital Era' by Dr. A. Madhava Rao, Dr. K. C. Vora & Seema Das in November 2016 at National Conference on Building Digital India: Enhancing Capabilities Through Libraries and Information
- 'Overview of Child Safety in Transportation in India' by D. D. Kulkarni, G. D. Mankeshwar & A. V. Mannikar in December 2016 at International Conference on Child Protection, Germany
- 'Cost optimization techniques for Heat Treatment and Lubrication system in a Forging Process by P. K. Ajeet Babu & M. R. Saraf in December 2016 at Forgetech, Delhi
- 'Performance evaluation of EV/HEV Systems using xEV Offline Simulator' by S. R. Ghugal in January 2017 at SIAT 2017, Pune
- 'Full Matrix OBD Verification and Validation of EMS using Hardware in Loop Simulation' by Anand Subramaniam in January 2017 at SIAT 2017, Pune
- 'Development of indigenous automated system to evaluate clutch performance under real world conditions' by Pravin Lavangare in January 2017 at SIAT 2017, Pune
- 'Systematic evaluation of 20% Ethanol Gasoline Blend (E20) as a Potential Alternate Fuel' by Moqtik A. Bawase & M. R. Saraf in January 2017 at SIAT 2017, Pune
- 'Optimization in Tube Yoke Forging Process using Computer Simulation' by A. R. Kumbhar, J. M. Paranjpe & N. V. Karanth in January 2017 at SIAT 2017, Pune
- 'Methodology for Prediction of Windscreen Wiping Area through Simulation' by M. S. Bhatkhande, A. P. Joshi, R. S. Mahajan & N. V. Karanth in January 2017 at SIAT 2017, Pune
- 'LCV Chassis Frame Optimization using Combined Simulation and Experimental Approach' by H. Rajesh, M. A. Patwardhan, N. V. Karanth, M. S. Bhatkhande, R. Ramkumar, Ninad Pachhapurkar & M. R. Saraf from ARAI and Dr. Y. P. Reddy from Sinhagad College of Engineering in January 2017 at SIAT 2017, Pune

- 'Measurement and Prediction of Sound Absorption of Sound Package Materials in Large and Small Reverberation Room' by S. K. Jain, M. P. Joshi, P. P. Kamble, H. D. Bankar & N. V. Karanth in January 2017 at SIAT 2017, Pune
- 'Sound Quality Evaluation of a Brake and Clutch Pedal Assembly used for Automotive Applications' by R. Ramkumar, Shriniwas Chivate & N. V. Karanth in January 2017 at SIAT 2017, Pune
- 'Acoustic Enclosure Optimization for a Higher Capacity Diesel generator set using Statistical Energy Analysis (SEA) based approach' by P. S. Yadav, H. D. Bankar & N. V. Karanth in January 2017 at SIAT 2017, Pune
- 'Sound Quality Rating of Passenger Car Diesel Powertrains' by A. Gaikwad, Keshav Mutalik, Shriniwas Chivate & N. V. Karanth in January 2017 at SIAT 2017, Pune
- 'Quantification of NVH Parameters in DC Electric Motors used for Automobile Applications' by Gaurav Shinde, R. Ramkumar & N. V. Karanth in January 2017 at SIAT 2017, Pune
- 'Study of In-Cylinder Tumble Effect on Spark Ignition Direct Injection (SI-DI) Engine Performance Using Gasoline, CNG & E85 Fuels and Simulation Technique' by Prasanna Sutar, Ashwin Dsouza, S. B. Sonawane, S. D. Rairikar, K. P. Kavathekar, Dr. S. S. Thipse, N. V. Marathe, Siddaling Bhure, and Mubeen Mapkar in January 2017 at SIAT 2017, Pune
- 'Review on Advanced Low Temperature Combustion Approach for BS VI' by Subhanker Dev, H. B. Chaudhari, S. B. Gothekar, Dr. S. Juttu, Dr. N. H. Walke & N. V. Marathe in January 2017 at SIAT 2017, Pune
- 'Virtual Engine Optimization from Design to Experimentation' by Prashant Pawar, Alen Jose, H. B. Chaudhari, Dr. S. Juttu, Dr. N. H. Walke & N. V. Marathe in January 2017 at SIAT 2017, Pune
- '1D Simulation Modeling of SCR Catalyst at Steady State Condition' by H. B. Chaudhari & Mohak P. Samant at in January 2017 at Gamma Technologies Indian User Conference 2017, Pune
- 'Integrated Approach for Development of Air Suspension system for a SUV Category Vehicle using Analytical and Experimental tools' by Sarang Bire, P. R. Pawar & M. R. Saraf in January 2017 at SIAT 2017, Pune
- 'Generation of 3D-Digital Indian Public Road Profile Database and its application for Vehicle Development through Road-Vehicle Interaction Study' by P. R. Pawar, Omkar Joshi & M. R. Saraf in January 2017 at SIAT 2017, Pune
- 'Development of Road to Lab Steering Test Rig (ROLAST)' by Jyoti Kale, Satish Kumar, Pravin Lavangare & Anand Subramaniam in January 2017 at SIAT 2017, Pune
- 'Design and development of Control Strategy for Adaptive Front-Lighting System suitable for Indian Road and Traffic Conditions' by M. Siva, Vishakha Bhagat, B. V. Shamsundara & A. V. Mannikar in January 2017 at SIAT 2017, Pune
- 'Biodiesel from Microalgae' by R Nagarajan, Aatmesh Jain & Dr. K. C. Vora in January 2017 at SIAT 2017
- 'Design & Optimization of Electric Wheel-Chair' by Puneet Kongi & Mohammad Rafiq B Agrewale in January 2017 at Conference on Automobile Engineering (ICAE-2017), organized by PSG College of Technology, Coimbatore
- 'Design & Development of Impact Energy Absorbing Bumper' by Amit Chege, Kshitij, Abhishek Kale, Mohammad Rafiq B Agrewale & Dr. K. C. Vora in January 2017 at Conference on Sustainable Development in Design & Manufacturing, organized by Saraswati College of Engineering, Navi Mumbai
- 'Forgeability Study of AA6061 Alloy during Cold Upsetting of Cylindrical Billets' by P. K. Ajeet Babu in February 2017 at National Seminar on Aerospace Structures, Vellore
- 'An Upper Bound Elemental Technique for Load Prediction of Axisymmetric Hot Forged Specimens' by P. K. Ajeet Babu, Jibin Babu & M. R. Saraf in January 2017 at SIAT 2017, Pune
- 'Design and Analysis of Intake System of Race Car' by Dr. K. C. Vora & Mohammad Rafiq B Agrewale in

- February 2017 at International Conference and Workshop on Advances in Mechanical Engineering (ICWAME-2017), Mumbai
- 'Low Temperature Combustion with two-shot Injection Strategies for simultaneous reduction of NO_x and PM in Compression Ignition Engines' by Nikhil Khedkar, P. Brijesh of ARAI and Vehzan Rustomji & S. Sreedhara of IITB in February 2017 at International Conference on Sustainable Energy and Environmental Challenges (SEEC-2017), Mohali
 - 'Design and Shape Optimization of Boat Tail for Commercial Vehicle' by Korlapati Chowdaiah, Kushal Kumar Chode, Mohammad Rafiq B Agrewale & Dr. K. C. Vora in February 2017 at International Conference and Workshop on Advances in Mechanical Engineering (ICWAME-2017), Mumbai
 - 'Automotive Emission Control & After Treatment' by Dr. K. C. Vora in March 2017 at Seminar on Automotive Emission Control & After Treatment at Amal Jyothi CoE, Kanjirappally, Kerala
 - Keynote on 'Overview of Emission Scenario' by Dr. K. C. Vora in March 2017 at International Conference on Intelligent Transport System and Vehicle Technology (ITSVT-2017) organized by Karpagam CoE, Coimbatore
 - 'Angular Torque Methodology for Cylinder Head Bolted Joint and Validation by FE and Experimental Work' published in International Journal of Manufacturing, Materials, and Mechanical Engineering (IJMMME) 6(4) October-December 2016 by A. V. Marathe & N. V. Marathe of ARAI and G. Venkatachalam of VIT University, Vellore
 - 'Effect of Cylinder Head Bolt Preload on Piston Ring conformability and Engine Blow by' published in International Journal of Current Engineering and Technology, Special Issue – 5, June 2016 by Mohammad Sami Malik & N. S. Gohel of Department of Mechanical Engineering SCoE, Savitribai Phule Pune University, Pune and A. V. Marathe of ARAI
 - 'Injury Prediction using Vehicle Accident Reconstruction and CAE Tool' published by M. G. Vhanaje & S. R. Deshpande of ARAI and Prof. C. S. Pathak of Sinhgad Institute of Engineering in International Engineering Research Journal, November 2016
 - 'Characterization of the Ultrafine and Nano Particle Emissions on Modified Indian Driving Cycle for Passenger Cars operating on Gasoline – Operating Phase Wise Analysis' published in International Journal of Applied Engineering Research (IAER) 10(71):566-573, 2015, by Dr. H. A. Nakhawa & Dr. S. S. Thipse
 - 'Characterization of the Ultrafine and Nano Particle Emissions on Modified Indian Driving Cycle for Passenger Cars operating on CNG Phase Wise Analysis' published in Advanced Engineering Forum (AEF) 14:86-96, by Dr. H. A. Nakhawa & Dr. S. S. Thipse
 - 'Comparative study of Characterization of the Ultrafine and Nano Particle Emissions on Modified Indian Driving Cycle for Passenger Cars operating on Diesel and CNG – Phase Wise Analysis' published in International Journal of Engineering Research in Africa (JERA) 20:41-50, by Dr. H. A. Nakhawa & Dr. S. S. Thipse
 - 'Transient behaviour of Particle Emissions from Diesel, Gasoline and CNG Passenger Cars' published in Journal of Basic and Applied Research International 15(4):241-249, 2016, by Dr. H. A. Nakhawa & Dr. S. S. Thipse
 - 'Physical and Chemical Characterization of Particulates from Passenger Cars operating on Diesel, Gasoline and CNG' published at International Conference on Automotive Technology (ICAT 2016), by Dr. H. A. Nakhawa & Dr. S. S. Thipse

Business Development

New Services & Capabilities

- Anti-theft Device Certification
- Sleeper Coach Certification as per AIS 119
- Trailer UPD Certification as per AIS 113
- Certification of Vehicle Alarm System as per AIS 076
- Performance evaluation and testing of Traction Batteries
- Testing of Child Restraint Systems as per AIS072 / ECE R44
- Crash testing of Passenger Cars as per various NCAP protocols
- Deployment testing of Seat Belt Pre-tensioning devices
- Child Restraint Fixture (CRF) installation test as per ECE R14 and R16
- Laden tests on Seating Systems
- Molding Simulation
- MBD Simulation of Engine Governor Assembly
- Consultancy for AIS-052
- NVH Benchmarking Assessment on Off-Road Vehicles
- Simulation-based development of SCR System for automotive application
- SCR System design selection by Simulation technique
- Duty Cycle Recorder (Black Box type)
- Development Tool Kit for fuel consumption analysis and prediction
- Development of road vehicle interaction analysis software tool
- Road vehicle interaction analysis Tool Kit
- Prototype of Air Suspension System and Electrically Operated Power Steering System (EPAS)
- Abuse tests on crash sensing SOS Messaging devices mounted on Passenger Cars
- Suspension evaluation of SUV using 4 Degree of Freedom (4DOF) Multi-axis Technique
- AWD SUV Engine and Gear Box assembly using 8 and 9 Degrees of Freedom (DOF) Multi-axis Technique
- Strain measurement on PCB
- Multi-axis evaluation of cabin of off-road vehicles
- Four Poster durability in Climatic Chamber and BSR Subjective and Objective evaluation
- Slam Durability test of tail gate
- Measurement of vehicle operation patterns, driver behaviour in actual customer usage environment and automated report generation
- Sound Power evaluation of condensing units in Hemi-anechoic Chamber
- Noise measurement on Mining Machines
- Noise reduction on Single Cylinder Diesel Engine and Diesel Genset Enclosure
- Accelerated Ageing test of Plastic Films
- Closed loop testing of water based coolant sample
- Passenger Car interior and packaging evaluation as per SAE J1100
- Performance evaluation of Battery Operated Locomotive
- Assessment of High Speed Camera Models
- **Brand Building**
 - ARAI participated in eighteen exhibitions / seminars for reaching out to the automotive, component and allied industry and to strengthen business relations. ARAI showcased its state-of-the-art facilities and capabilities in design, development, testing and certification of automobiles and automotive components at these exhibitions.
 - ARAI also supported four events of SAEINDIA
 - Customer Meets organized at ARAI, ARAI – HTC and Chennai



Participants at CEO / CTO Meet at Chennai



Customer Meet in association with ACMA



R&D Meet organized with EEPC at Aurangabad



ARAI Stall at an Exhibition

- Customer Meet along with ACMA for component manufacturers
- Organizing of CEO / CTO Meet at Chennai for updating industry on ARAI's advanced capabilities
- Organizing of R&D meet with EEPC at Aurangabad
- Tech Pavilion set up at SIAT 2017 to display certification and technological capabilities
- Strategic visits to key customers
- **Technical Collaborations / Strategic Tie-ups**
 - MoU with Cognizant Technology Solutions (CTS) for development of an autonomous vehicle
 - Collaboration with BWF-Esslingen, Steinbeis-Transferzentrum, Bauteilfestigkeit und-sicherheit, Werkstoff-und Fügetechnik (BWF), Germany in the field of Metallurgical Failure Analysis studies
 - MoU with Christ University, Bengaluru for commencement of 4-Year B. Tech Programme in Automobile Engineering
 - Renewal of MoU with VIT University, Vellore for regular M. Tech & B. Tech ongoing programmes
 - Collaboration with UTAC CERAM, France for mutual sharing of technology and assistance in automotive testing

- **Workshops / Training Programmes / Seminars/Presentations**

- Workshops / Training Programmes organized at the behest of MoRTH
 - 'Overview of vehicle certification for emission and safety' at Gangtok and Kochi for RTO officers from east, west and southern regions
 - 'New Regulations for Buses, Trucks & Trailers' for personnel from Motor Transport Department
 - 'Overview on CMVR' for Transport Commissioners, Additional Transport Commissioners and Joint Transport Commissioners
 - 'Mobility Solutions and CMVR-procedures for approval of retro-fitment/ adaptation kit for vehicles, e-cars to be used by physically challenged persons' at Jaipur, Ahmedabad and Kochi

- Other Workshops organized
 - CNG / LPG Vehicle Technology and Certification at Kolkata
 - Fire Safety for CNG/LPG Fuel Vehicles
 - Bio-Fuel Technologies for Vehicles
- Seminar at ARAI Kothrud on Tyres – Technology and Regulations: A one day seminar organized to understand technology trends & upcoming regulations and ARAI's preparedness
- Customer meet and 1-day program organized on 'Enhancing Automotive Structural Performance – A Fatigue & Materials Evaluation Perspective' at Fatigue & Materials Centre of Excellence (FMCE) Lab, ARAI-HTC, Chakan
- Presentations on Pass by Noise : India Perspective' at GARC, Chennai and Advance Trends in Automotive NVH' at Henkel Ltd.



Workshop on 'Overview on CMVR'



Workshop on 'New Regulations for Buses, Trucks & Trailers'



Seminar on Tyres – Technology and Regulations



Customer Meet at Fatigue & Materials Centre of Excellence (FMCE) Lab, ARAI-HTC, Chakan

Events

SIAT 2017

Symposium on International Automotive Technology (SIAT) is a biennial event organized by ARAI in association with SAEIndia, NATRIP and SAE International (USA). The event features technical papers, key note papers and an expo (running concurrently) and attracts automobile professionals from all over the world.

Fifteenth edition of this symposium, SIAT 2017, was organized during 18th to 21st January 2017 at ARAI, Pune. The event was inaugurated by Shri Sanjay Mitra, Secretary, Ministry of Road Transport and Highways and Shipping, Government of India. The other dignitaries present on this occasion included Dr. R. K. Malhotra, President, SAE India; Shri Sanjay Bandopadhyaya, CEO, NATRIP; Shri T. Mookiah, Associate Director (R&D), VSSC; and Mr. Murli Iyer, Executive Advisor – Global, SAE International. The theme of this edition of the symposium was 'Smart, Safe and Sustainable Mobility', keeping in tune with automotive industry's latest trends and future challenges. During this inaugural ceremony, proceedings of SIAT 2017, India Emission Regulation Booklet and collection of cartoons on Road Safety by Late Shri Mangesh Tendulkar, were released. Also, ARAI Golden Jubilee award for the short film making contest on Road Safety Awareness was distributed. A significant event at this ceremony was unveiling of the 'Pilot Electric Vehicle' using indigenous Lithium ion Battery'.

SIAT 2017 was successful with participation of around 1400 delegates from 21 countries. During this symposium

40 keynote papers were presented and 205 technical papers published by experts from India and abroad. A notable feature of this edition was organizing of '4 Plenary Sessions', which were on Smart, Safe, Sustainable & Future mobility. It provided an ideal platform for the researchers around the globe to put forth and deliberate their ideas to address India specific and global challenges facing the automotive sector. Major focus in this symposium was on recent advancements in automotive technology in different areas such as safety, emissions, engines, electric mobility, electronics, intelligent transportation, etc. The symposium was complemented with SIAT EXPO 2017, which was organized concurrently with it. The exposition had 178 stalls showcasing latest technology solutions, products and services. Student Poster Presentation competition was also organized during this event. Based on the theme of SIAT 2017, posters were invited from UG, PG and Ph.D. students on topics, viz. Sustainable Mobility and Smart & Safe Vehicles.

The valedictory function was graced by Shri Anant Geete, Hon'ble Minister for Heavy Industries & Public Enterprises, Government of India as the Chief Guest and by Mrs. Eva Molnar, Director, Sustainable Transport Division, UNECE as the Guest of Honour. Various SIAT awards and ARAI Young Engineer award, which was a contest as part of Golden Jubilee Year Celebrations, were distributed during this function. Also, an automated vehicle (which is a part of a project on development of autonomous vehicle) was demonstrated on this occasion.



Inaugural Ceremony



Unveiling of Pilot Electric Vehicle

SIAT 2017 Awards

| Best Paper | | | |
|---|----------------------|--|--|
| Place | SAE Paper No. | Paper Title | Principal Author |
| First | 2017 - 26 - 0165 | Wear resistant and fuel efficient Ni-Co Based Composite Coating for Engine Cylinder Application | Dr. Meenu Srivastava, CSIR-National Aerospace Laboratories |
| Second | 2017 - 26 - 0119 | Optimization of Exhaust After-Treatment System (EATS) to BS 6 Emission Level for a Light Commercial Vehicle (LCV) Using Existing BS 4 Engine Results and 1-D Simulation Approach | Ragupathi Soundara Rajan, FEV India Pvt. Ltd. |
| Third | 2017 - 26 - 259 | A Novel Technique to Establish Various Important Characteristic to Analyze Complete Hydraulic Power Steering System using Model Based Design Approach | Sandeep V. Sawangikar Tata Motors Ltd. |
| Best Paper On Exhaust Emission | | | |
| --- | 2017 - 26 - 0056 | Achieving Bharat Stage VI Emissions Regulations While Improving Fuel Economy with the Opposed-Piston Engine | Suramya Naik, Achates Power Inc., USA |
| Best Paper On Electric Mobility | | | |
| --- | 2017 - 26 - 0094 | Model-in-the-Loop Testing of SOC and SOH Estimation Algorithms in Battery Management Systems | Shi Li, FEV GmbH, Germany |
| Best Indian Paper On Environmental Pollution | | | |
| --- | 2017 - 26 - 0072 | Systematic Evaluation of 20% Ethanol Gasoline Blend (E20) as a Potential Alternate Fuel | Moqtik Bawase, ARAI |
| Best Paper On Safety | | | |
| --- | 2017 - 26 - 0009 | A 0-D Calculation Template to Define Crush Space Requirement and Body Front End Force Level Requirement in Concept Stage | Abhinab Mohanty, Mahindra Research Valley |
| Best Paper On Simulation & Modelling | | | |
| --- | 2017 - 26 - 0113 | Multiphase Modelling of SCR Systems: Using the Taguchi Method for Mixer Optimization | Dr. Azael J. Capetillo, Katcon SA de CV, Mexico |
| Best Oral Presentation | | | |
| -- | 2017 - 26 - 0040 | Split Type Crankcase Design for a Single Cylinder LCV Diesel Engine | R. Bharani Dharan, Mahindra & Mahindra Ltd. |
| Best Poster Presentation | | | |
| -- | -- | Category: Smart & Safe Vehicles | Mr. Amit Gupta of CoEP |
| -- | -- | Category: Sustainable Mobility | Mr. Shravan Mutha of VNIT |

SIAT EXPO 2017 Stall Awards:

- First Prize: Bosch Ltd.
- Second Prize: AVL India Pvt. Ltd.
- Third Prize: KSPG Automotive India Pvt. Ltd.
- Appreciation Certificate: iASYS Technologies and KPIT Technologies Ltd.



ARAI Stall



Awards Ceremony

Next edition of Symposium on International Automotive Technology 2019 is scheduled to be held during 16th to 18th January 2019.

Golden Jubilee

ARAI celebrated its Golden Jubilee Year – signifying 50 years of strength, perseverance and endurance that has made it what it is today. Various programmes were organized to commemorate the golden jubilee during these yearlong celebrations. Golden Jubilee Celebrations at ARAI were launched on 3rd January 2016 at the auspicious hands of Shri Devendra Fadnavis, Hon'ble Chief Minister of Maharashtra; and in the august presence of Dr. K. Sivan, Director, Vikram Sarabhai Space Centre, Thiruvananthapuram. Golden Jubilee logo was released by the dignitaries on this occasion. As part of these celebrations, following programmes were organized.

- ARAI Golden Jubilee Scientist Meet to honour contribution of eminent scientists in various fields.
- ARAI Golden Jubilee Young Engineer award to recognize young engineers for their contribution for the benefit of automotive industry

- Short Film making contest on Road Safety Awareness held to address issues like driving conditions, safety gadgets, vehicle maintenance, pedestrian's safety etc.
- Exhibition of special cartoons on road safety was organized for creating awareness amongst the general public on the subject of Safety and Environmental protection
- Lecture Series by eminent personalities organized for ARAI Employees
- Inter departmental sporting events for ARAI Employees
- Release of 'ARAI Golden Jubilee Souvenir' and '50 Years of ARAI Publications'



Scientists Meet



Road Safety Cartoons Exhibition



Lecture Series – The Wellness Concept



Inter-departmental Sporting Event

Supporting SAEINDIA Activities

ARAI is associated with SAEINDIA's wide spectrum of activities which are carried out for the benefit of practicing engineers, faculty, engineering students and school children. SAEINDIA Western Section (SAEI WS) organizes training and educational programmes, workshops and knowledge dissemination activities for enhancing human resource skills to meet the growing industry requirements. ARAI has been conferred with Corporate Award for its support to SAEINDIA activities during the SAEINDIA Foundation Award Ceremony held at Indian Habitat Centre, New Delhi on 20th October 2016.

• Eminent Speaker Series Lectures

- ◆ 'Autonomous Cars: Journey From Passion To Invention' by Dr. Roshy John, Practice Head, Robotics and Cognitive Systems, TCS held at ARAI
- ◆ 'Importance of Measuring Particulate Emission PM & PN from Engines – Pegasor's Technology

Overview' by Mr. Markku Rajala, Head of Technology, Pegasor OY, Finland held at ARAI

- ◆ 'Success Story of Fleetguard Filters in Reducing Time Required for Engineering Designs using Theory of Constraints' by Mr. Sadashiv Pandit, Executive Chairman, Fleetguard held at ARAI
- ◆ 'Building Professional Career for Women Engineers' by Mrs. Rashmi Urdhwareshe, Director - ARAI held at Indore
- **Tech Talk Series Lecture held at ARAI:**
 - ◆ 'Efficient Physico-Chemical Simulation of Fuels, Combustion and Emissions in IC Engines' by Dr. Amit Bhawe, Chief Executive Officer, CMCL Innovations
 - ◆ 'Managing Emotional Intelligence' by Brigadier Deepak Bhat, VSM Retd., Regional Business Head, Talent Makers

• **Workshops held at ARAI:**

- ◆ 'Teaching Methods & Strategies' workshop by Ms. Anja Cudok, Mr. Theodor C. Schultz and Dr. K. C. Vora in association with Braunschweig University, Germany
- ◆ 'Future Powertrain: Role of Vehicle Thermal Management & Waste Heat Recovery Technology' by CSEG's Mr. Sudhi Uppuluri, Principal Investigator, Mr. Hemant Khalane & Mr. Ajay Naiknaware Lead Systems Engineers
- ◆ Latest Trends in Sustainable Automotive Technology' at Institute of Engineering & Technology, DAVV, Indore
- ◆ Current State of the Art - Random Response and Fatigue Technology' by Dr. Neil Bishop of CAEfatigue Ltd.

- ◆ Off Highway Machinery – Standards & Regulations' by Mr. Krishnat Patil & Mr. Karthik Kaliappan from John Deere

• **Other Activities:**

- ◆ Mrs. Rashmi Urdhwarshhe, Director – ARAI participated in SAEINDIA Automotive Round Table Conference as a panelist
- ◆ ARAI sponsored 'A World In Motion' (AWIM) Pune Olympics held at SNBP International School, Baner, Pune on 10th December 2016 AWIM National Olympics held at Mapple Emerald Hotel, New Delhi on 7th January 2017
- ◆ Sponsored BAJA SAEINDIA held at NATRAX facility at Pithampur, Indore
- ◆ ARAI sponsored SUPRA SAEINDIA held at BIC, Greater Noida



SAEINDIA Foundation Corporate Award to ARAI



AWIM Pune Olympics



SAEINDIA Automotive Round Table Conference at Pune



BAJA SAEINDIA at Pithampur

Knowledge Centre

Knowledge dissemination and skill development activities are carried out through Knowledge Centre since 2004. It includes training and educational programmes to enhance human resource skills for meeting the growing needs of the automotive industry. Knowledge Centre at ARAI carries out these activities through Learning Centre (LC), Training Centre (TC) & Library.

Learning Centre

Learning Centre conducts undergraduate, postgraduate and doctorate programmes with specialization in Automotive Engineering through collaborations with various universities. It has tie-ups with VIT University (Vellore), VELTECH University (Chennai), Christ University (Bengaluru), College of Engineering (Pune), University of Alabama (USA), Tennessee Tech University (USA), Loughborough University (UK) and Technical University of Braunschweig (Germany). Brief summary of the joint programmes conducted is given below.

| UNIVERSITY | SPECIALIZATION |
|-------------------------------------|---|
| VIT University, Vellore | • B. Tech. in Mechanical Engineering with specialization in Automotive Engineering |
| | • M. Tech. in Automotive Engineering |
| | • M. Tech. for Industry Professionals with specialization in Engine Technology, Powertrain Electronics and Manufacturing & Industrial Engineering (Various organizations from the automotive fraternity have collaborated with ARAI to admit their engineers for above programmes) |
| | • Ph.D. in Automotive Engineering |
| VEL TECH University, Chennai | • B. Tech in Mechanical Engineering with specialization in Automotive Engineering in association with GARC, Chennai. |
| | • M. Tech. in I. C. Engines and Electronics Engineering with specialization in Automotive Electronics |
| College of Engineering, Pune | • M. Tech. in Automotive Technology |
| Alabama Birmingham, USA | • M. S. in Mechanical Engineering with Automotive Engineering Emphasis |
| Christ University, Bengaluru | • B. Tech. in Automobile Engineering |

Training Centre

Training Centre organizes Proficiency Improvement Programmes (PIPs) & Domain Training Programmes (DTPs). This year, 34 PIPs & 4 DTPs were organized through Kothrud location and 24 PIPs & 1 DTP were organized through ARAI FID-Chakan location, wherein training was given by ARAI personnel, academicians and eminent industry experts, including speakers from abroad. These PIPs & DTPs had a participation of over 2200 delegates and were conducted in the following areas of Automotive Engineering, I.C. Engines, Automotive Electronics, Materials, Manufacturing, Quality and Industrial Engineering:

PROFICIENCY IMPROVEMENT PROGRAMMES (PIPs)

- Advance Material & Characterization
- Advanced Automotive Engineering (at Christ University, Bengaluru)
- Advanced Automotive Engineering (at GIT, Belagavi)
- Advanced Fluid Mechanics
- Advanced Heat Transfer
- Advanced Manufacturing Technology
- Applied Engineering Mathematics
- Automotive Electronics & Embedded System
- Automotive EMI/EMC
- Automotive Engineering
- Automotive Fuels & Energy
- Automotive Functional Safety (ISO 26262)
- Automotive Life Cycle Engineering
- Automotive Sensors & Actuators
- Basics of Reliability Engineering
- Business Statistics & Operation Research
- CNC Technology and Programming
- Current State-of-the-art Random Response and Fatigue Technology
- Design for Manufacturing
- Design of Experiments
- Embedded System Design
- Engine Control Systems
- Engine Design and Development
- Engine Electronics & Management System
- Engine Emission & Control
- Engine Noise & Vibration: Challenges & Solutions
- Engine Testing & Certification
- ERP and Supply Chain Management
- Failure Analysis (Engine components included)
- Failure Mode & Effect Analysis
- Fluid Power System & Factory Automation
- Foundry Technology
- Fundamental of Communication Skill
- Future Powertrain: Role of Vehicle Thermal Management & Waste Heat Recovery Technology

- Geometrical Dimensioning & Tolerancing
- Heat Treatment
- Human factor in design and manufacturing
- Hybrid Drives, Traction & Controls
- Lithium Batteries and Battery Management Systems
- Mechatronics and Automation
- Mechatronics in Manufacturing
- Metallurgy for Non-metallurgist
- Off-Highway Machinery- Standards & Regulation
- Powertrain Engineering
- Powertrain NVH
- Principles of Industrial Engineering
- Professional development for engineers
- Quality Management
- Robotics & Industrial Automation
- Software development life cycle management
- Systematic innovative Thinking
- Systems Engineering
- Teaching Methods & Strategies
- Technical English
- Thermodynamics analysis of IC engine
- Transmission Control Systems

DOMAIN TRAINING PROGRAMMES (DTPs)

- Automotive Electrical & Electronic Systems with Emphasis on 2/3 Wheelers
- Basics & Advances in Heat Treatment
- Engine Testing & Certification (Twice)
- Latest Trends in Design and Development of I. C. Engine

e-PROFICIENCY IMPROVEMENT PROGRAMMES (e-PIPs)

In line with PIPs, we have also started providing quality E-Learning courses (e-PIPs). These highly engaging and effective online training courses are available on ARAI Learning Management System (LMS). The topics offered under this programme include Reliability Engineering and Engine Electronics & Management Systems (EEMS).

Library

The well-equipped and fully computerized library at Knowledge Centre caters to the information needs of in-house researchers, faculty members and academy students. It also serves professionals, faculty, students and various government organizations with vast information in print and digital format. It has a collection of around 23000 books & standards, 75000 SAE Technical papers, 500 SAE Special publications and Academy Project Reports on various topics like powertrain, electric & hybrid vehicles, emissions, NVH, brakes, fatigue, vehicle

dynamics, safety, automotive electronics, automotive materials, management, soft skills, etc.

During the year 2016-17, it added 104 books, 80 standards and subscribed to 36 journals, SAE digital library, SANS standards from South African Bureau of standards & selected sections of BIS standards. Also, over 15500 professionals and students (including E- visitors) availed the library's services during this period. It also has published a Book & a CD covering fifty years of ARAI publications.



Convocation Ceremony



Batches passing out in 2017



PIP on Advanced Automotive Engineering at GIT, Belagavi



PIP on Engine Emission & Control

Get Trained on the latest Automotive topics Anywhere, Anytime...
Become a Certified Reliability Expert (CRE)



E-PIP highlights:

- Latest and up-to-date content
- Highly interactive, engaging and effective
- Real-life industry examples
- Hands-on practice in virtual environment
- Pre and Post assessments to assess learner's knowledge.
- Certificate on passing the Final Assessment

Contact Information:

Phone: +91-20-30231239
Email: patil.pga@araiindia.com

Overview:

In today's highly competitive automotive industry, "Reliability" is not only important for reducing component/subassembly failures or improving warranties; but also for building **brand trust** among the customers and gaining a **competitive edge**!

ARAI Academy presents a **comprehensive eLearning Proficiency Improvement Program (e-PIP) on 'Reliability Engineering'** for students, faculty and working professionals.

On completing this course successfully, learner will become a **Certified Reliability Expert (CRE)**. CRE is a professional who understands the principles of performance evaluation and prediction to improve product/systems safety, reliability and maintainability.

Course Content:

- Introduction to Reliability Engineering (Including Bathtub Curve, Failure Rate Behavior)
- Reliability Statistics and Distributions
- Life Data Analysis (Using Minitab software) – part 1
- Life Data Analysis (Using Minitab software) – part 2
- Warranty Data Analysis
- Reliability Block Diagrams
- Reliability Testing Methods (ALT, HALT, HASS, ESS, etc...)
- Sample Size in Reliability Testing

| | | | | | |
|------------------------------------|---------|------|--|-------|--|
| Course Cost (INR) (Excl. taxes) | Student | 2500 | Corporate (Individual company sponsored) | 7000 |  |
| | Faculty | 4000 | Corporate – Perpetual (15 licenses - 1 yr - Minimum 45 Licenses per corporate) | 50000 | |

e-PIP on Reliability Engineering

Get Trained on the Latest Automotive Topics Anywhere, Anytime...
Become a certified professional with our EEMS course.



E-PIP highlights:

- Up-to-date content
- Highly engaging, interactive and effective
- Real-life industry examples
- Assessments to assess learner's knowledge
- Certificate on passing the final assessment

Contact Information:

Phone: +91-20-30231239
Email: patil.pga@araiindia.com

Overview:

In today's highly competitive world, knowledge on the latest updates in the automotive world is important. We bring this up-to-date information from the best minds in the industry.

ARAI Academy and Bosch together present a comprehensive eLearning Proficiency Improvement Program (e-PIP) on 'Engine Electronics & Management system' (EEMS) for students, faculties and working professionals.

On completing this course successfully, learner will get an acknowledgement certificate.

Course Content:

- Fundamentals of Automotive Electronics
- ECU, Microcontrollers and Memories
- Sensors & Actuators
- Automotive Control Systems
- Engine Management System
- Calibration and Diagnostics
- Standards

| | | | | | |
|------------------------------------|---------|-------|--|--------|---|
| Course Cost (INR) (Excl. taxes) | Student | 7500 | Corporate (Individual company sponsored) | 20000 |   |
| | Faculty | 12500 | Corporate – Perpetual (15 licenses - 1 yr - Minimum 45 Licenses per corporate) | 150000 | |

e-PIP on Engine Electronics and Management System

ARAI Homologation and Technology Centre (ARAI - HTC), Chakan

ARAI's Homologation and Technology Centre at Chakan has commenced its operations with customer centric approach. The three labs at this centre, i.e. Passive Safety Laboratory, Fatigue Laboratory and Powertrain Laboratory; have executed various projects for the customers. They have demonstrated their capabilities and competencies meeting specific requirements of the customers. This centre has successfully established itself with execution of projects on test results proving & inter-lab correlation and also has implemented OEM specific practices for seat testing on sled.

Pedestrian, Sled and Crash facilities at the Passive Safety Lab have been utilized for various projects of the customers. Dummy calibration lab and Sled test facility have been accredited by NABL and Pedestrian test facility has been certified by VCA. Fatigue Lab at this centre has successfully carried out a project on Buzz, Squeak & Rattle (BSR) measurement, which involved data acquisition and simulation of BSR Synthetic tracks and subjective BSR assessment tests on new vehicles using drive in four poster and acoustic treated chamber facility. The NVH measurement was carried out for noise reduction through acoustic transfer function measurements, acoustic material effectiveness / evaluation for transmission loss properties and vehicle interior cavity study through noise transfer function. Powertrain Lab has carried out projects for certification and mileage accumulation on chassis dynamometer. In addition to these, cold startability evaluation, temperature effect & performance evaluation on HVAC, engine cooling circuit and solar simulation test services were also provided.

ARAI – HTC's 1st anniversary was celebrated on 4th January 2017. This occasion was graced by Mr. Rajendra Petkar, Head of the Department – Power System Engine ERC, Tata Motors Ltd. as the Chief Guest and Mr. Kamlakar Takawale, HR Head – Volkswagen India Pvt. Ltd. as the Guest of Honour. Over 100 ex-employees of ARAI were specially invited for the function and a tour of the HTC facility was arranged for them.



Dummies



Buzz, Squeak & Rattle (BSR) Measurement



Cold Startability Evaluation in CVTC Soak Room



Celebration of ARAI – HTC's 1st Anniversary

- Independent Auditors' Report

- Annual Statement of Accounts

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Independent Auditors' Report

To

The Members

The Automotive Research Association of India, Pune

Report on Financial Statements

We have audited the accompanying financial statements of **The Automotive Research Association of India** which comprises the Balance sheet as at 31st March 2017 and Income and Expenditure Accounts for the year then ended and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation of these financial statements that give a true and fair view of the financial position and financial performance in accordance with the accounting principles generally accepted in India, including the Accounting Standards.

This responsibility also includes maintenance of adequate accounting records for safeguarding of the assets of the Association and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance of adequate internal financial controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the Association's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of the accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide basis for our audit opinion..

4. Opinion

In our opinion and to the best of our information and according to explanation given to us, financial statements give a true and fair view in conformity with the accounting principles generally accepted in India:

- i. In the case of the balance sheet of the state of affairs of the Association as on 31st March 2017 and
- ii. In the case of income and expenditure account of the SURPLUS for the year ended on that date

Other Matters

The financial statements for the year ended 31st March 2016 were audited by other auditors who have expressed an unqualified opinion on those financial statements. The report was issued on 30th June 2016

For M/s P. G. Bhagwat
Chartered Accountants
Firm Registration No.101118W

Place : Pune

Abhijeet Bhagwat
Partner

Dated : 10th July 2017

Membership No. 136835

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Balance Sheet as on 31st March 2017

(Rs. in Lakhs)

| PARTICULARS | SCH NO | | AS ON 31-03-2017 | | AS ON 31-03-2016 |
|---|--------|-----------|---------------------|-----------|---------------------|
| SOURCES OF FUNDS | | | | | |
| 1. GENERAL & OTHER FUNDS | | | | | |
| A) GENERAL FUND | 1 | 63,042.47 | | 55,810.48 | |
| B) R & D RESERVE FUND | 2 | 24,120.68 | | 22,999.66 | |
| C) REPLACEMENT OF EQUIPMENT/ MACHINERY FUND | 3 | 10,734.55 | | 10,514.72 | |
| D) ENDOWMENT FUND | 4 | 14.85 | | 16.18 | |
| E) ARAI ACADEMY ALUMNI ASSOCIATION FUND | 5 | 8.93 | 97,921.48 | 7.22 | 89,348.26 |
| 2. PROJECT FUNDS (NET) | 6 | - | 3,630.36 | | 4,771.80 |
| 3. CURRENT LIABILITIES AND PROVISIONS | 7 | - | 10,018.46 | | 7,211.97 |
| TOTAL | | | 111,570.30 | | 101,332.03 |
| APPLICATION OF FUNDS : | | | | | |
| 1. FIXED ASSETS | 8 | | 49,945.88 | | 47,678.37 |
| 2. CURRENT ASSETS, DEPOSITS AND ADVANCES | | | | | |
| A) INVENTORIES | 9(A) | 35.32 | | 29.21 | |
| B) SUNDRY DEBTORS | 9(B) | 3,176.34 | | 3492.14 | |
| C) DEPOSITS, CASH & BANK BALANCES | 9(C) | 56,044.16 | | 48,463.75 | |
| D) ADVANCES | 9(D) | 2,111.15 | | 1,412.83 | |
| E) SUNDRY DEPOSITS | 9(E) | 257.45 | 61,624.41 | 255.73 | 53,653.66 |
| TOTAL | | | 111,570.30 | | 101,332.03 |
| NOTES TO THE ACCOUNTS | 15 | | | | |

Mrs Rashmi Urdhwarshre
Director

Rajan Wadhwa
President

Vikram Kirloskar
Vice President

AS PER OUR
REPORT OF EVEN DATE
FOR M/S P. G. BHAGWAT
CHARTERED ACCOUNTANTS
F. R. No.101118W

ABHIJEET BHAGWAT
PARTNER
Membership No. 136835

Date : 10th July 2017
Place : Pune

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Income and Expenditure Account for the Year Ended 31st March 2017

(Rs. in Lakhs)

| PARTICULARS | SCH NO | YEAR ENDED 31-03-2017 | YEAR ENDED 31-03-2016 |
|--|--------|-----------------------|-----------------------|
| INCOME | | | |
| SPONSORED PROJECTS, TESTING, LEARNING & TRAINING CENTRE | 10 | 24,614.67 | 21,114.65 |
| ANNUAL MEMBERSHIP SUBSCRIPTION | - | 430.46 | 416.87 |
| SIAT 2017 | - | 798.94 | - |
| FUNDS TRANSFERRED FROM R&D RESERVE FUND | - | 66.33 | 64.68 |
| INTEREST | 11 | 2,774.30 | 3,865.64 |
| OTHER INCOME | 12 | 295.02 | 337.64 |
| TOTAL | | 28,979.74 | 25,799.48 |
| EXPENDITURE | | | |
| SPONSORED PROJECTS, TESTING, LEARNING & TRAINING CENTRE EXPENSES | - | 2,445.09 | 2,265.33 |
| ARAI R&D PROJECTS | - | 66.33 | 64.68 |
| SALARIES & OTHER ALLOWANCES | 13 | 11,809.74 | 9,279.25 |
| EMPLOYEE RELATED EXPENSES | - | 332.20 | 251.99 |
| OPERATION & ESTABLISHMENT EXPENSES | 14 | 3,395.91 | 2,889.10 |
| DEPRECIATION | - | 3,291.84 | 2,608.24 |
| LESS: DEPRECIATION ON GOVT. FUNDED ASSETS | | 1,324.71 | 1,132.95 |
| SIAT /GOLDEN JUBILEE EXPENSES | - | 588.56 | 97.33 |
| EXCESS OF INCOME OVER EXPENDITURE | | 8,374.78 | 9,476.51 |

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Income and Expenditure Account for the Year Ended 31st March 2017

(Rs. in Lakhs)

| PARTICULARS | SCH NO | YEAR ENDED 31-03-2017 | YEAR ENDED 31-03-2016 |
|--|--------|-----------------------|-----------------------|
| APPROPRIATION | | | |
| A) INTEREST ON EARMARKED FUNDS TRANSFERRED TO RESPECTIVE FUNDS | | | |
| - R & D RESERVE FUND | | 1,187.34 | 1,417.38 |
| - REPLACEMENT OF EQUIPMENT/ MACHINERY FUND | | 219.83 | 1,407.17 |
| | | | 1,081.09 |
| | | | 2,498.47 |
| B) LEARNING CENTRE AND SIAT | | | |
| - SURPLUS (DEFICIT) OF SIAT 2017 TRANSFERRED TO GENERAL FUND | | 210.38 | 210.38 |
| | | | - |
| | | | - |
| C) EXCESS OF INCOME OVER EXPENDITURE (NET) | | 6,757.23 | 6,978.04 |
| TOTAL | | 28,979.74 | 25,799.48 |
| NOTES TO THE ACCOUNTS | 15 | | |

Mrs Rashmi Urdhwareshe
Director

Rajan Wadhwa
President

Vikram Kirloskar
Vice President

AS PER OUR
REPORT OF EVEN DATE
FOR M/S P. G. BHAGWAT
CHARTERED ACCOUNTANTS
F. R. No.101118W

ABHIJEET BHAGWAT
PARTNER
Membership No. 136835

Date : 10th July 2017
Place : Pune

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Schedules Forming Part of Balance Sheet as on 31st March 2017

(Rs. in Lakhs)

| PARTICULARS | NOTE (Refer Schedule 13) | AS ON 31-03-2017 | AS ON 31-03-2016 |
|--|--------------------------------|---------------------|---------------------|
| SCHEDULE NO. 1: GENERAL FUND | | | |
| AS PER LAST BALANCE SHEET | | 58,807.98 | 51,315.45 |
| ADD: PROJECTS CAPITALISED | I (4) | 1,912.99 | 2,839.50 |
| ADD: MEMBERSHIP ENTRANCE FEE | - | 0.80 | 0.60 |
| LESS: DEPRECIATION ON GOVT.PROJECTS | I (3) (a) | 866.14 | 674.40 |
| ADD : PRE OPERATIVE EXPENSES FOR NATRIP PROJECT | - | - | 175.11 |
| ADD: SURPLUS (DEFICIT) OF SIAT 2017 | - | 210.38 | (1.90) |
| LESS: DE-CAPITALISATION OF ASSETS | I (10) (V) (3) | 3,519.91 | 3,458.42 |
| LESS : EXCESS EXPENSES ON GOVT. PROJECTS | | 250.87 | 1,363.50 |
| LESS : ARAI's SHARE IN CESS PROJECTS | I (10) (IV) (a) | 10.00 | - |
| ADD: EXCESS OF INCOME OVER EXPENDITURE FOR THE YEAR | | 6,757.23 | 6,978.04 |
| TOTAL | | 63,042.47 | 55,810.48 |
| SCHEDULE NO. 2: R&D RESERVE FUND | | | |
| AS PER LAST BALANCE SHEET | | 22,999.66 | 21,646.96 |
| ADD : INTEREST | I (10) (A) (ii) | 1,187.34 | 1,417.38 |
| LESS : UTILISED DURING THE YEAR | I (10) (B) (ii) | 66.32 | 64.68 |
| TOTAL | | 24,120.68 | 22,999.66 |
| SCHEDULE NO. 3: REPLACEMENT OF EQUIPMENT/MACHINERY FUND | | | |
| UPTO LAST YEAR | | 10,514.72 | 9,433.63 |
| ADD : INTEREST | I (10) (A) (i) | 219.83 | 1,081.09 |
| TOTAL | | 10,734.55 | 10,514.72 |
| SCHEDULE NO. 4: ENDOWMENT FUND | | | |
| AS PER LAST BALANCE SHEET | | 16.18 | 14.85 |
| ADD: INTEREST | | 1.42 | 1.33 |
| LESS : UTILISED DURING THE YEAR | | 2.75 | 0.00 |
| TOTAL | | 14.85 | 16.18 |
| SCHEDULE NO. 5: ARAI ACADEMY ALUMNI ASSOCIATION FUND | | | |
| AS PER LAST BALANCE SHEET | | 7.22 | 4.28 |
| ADD: RECEIPTS | | 1.44 | 2.92 |
| ADD: INTEREST | | 0.30 | 0.22 |
| LESS : UTILISED DURING THE YEAR | | 0.03 | 0.20 |
| TOTAL | | 8.93 | 7.22 |

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Schedules Forming Part of Balance Sheet as on 31st March 2017

(Rs. in Lakhs)

| PARTICULARS | AS ON 31-03-2017 | AS ON 31-03-2016 |
|--|---------------------|---------------------|
| SCHEDULE NO. 6: PROJECT FUNDS (NET) | | |
| (A) FUNDS FOR CESS PROJECTS (DHI) | | |
| AS PER LAST BALANCE SHEET | 1,523.54 | 85.87 |
| LESS : RECOUPMENT OF UTILISATION OF ARAI FUNDS | - | - |
| ADD: RECEIVED DURING THE YEAR | 1,495.00 | 2,336.50 |
| ADD: UTILISED ARAI FUND | - | - |
| TOTAL FUNDS AVAILABLE | 3,018.54 | 2,422.37 |
| LESS: REFUNDED TO MINISTRY | 563.74 | 35.14 |
| LESS: EXPENDITURE INCLUDING ADVANCES | 980.06 | 863.69 |
| NET AMOUNT AVAILABLE AS PER APPENDIX I ATTACHED | 1,474.74 | 1,523.54 |
| (B) FUNDS FOR NATRIP PROJECTS | | |
| AS PER LAST BALANCE SHEET | 8.39 | 198.72 |
| ADD: RECEIVED DURING THE YEAR | - | - |
| ADD: EXCESS EXPENSES BORNE BY ARAI | 247.78 | 1,363.50 |
| TOTAL FUNDS AVAILABLE | 256.17 | 1,562.22 |
| LESS: EXPENDITURE INCLUDING ADVANCES | 256.17 | 1,553.83 |
| NET AMOUNT AVAILABLE AS PER APPENDIX II ATTACHED | - | 8.39 |
| (C) FUNDS FOR IMPC PROJECTS | | |
| AS PER LAST BALANCE SHEET | 348.45 | 301.74 |
| ADD: RECEIVED DURING THE YEAR | 355.50 | 481.06 |
| TOTAL FUNDS AVAILABLE | 703.95 | 782.80 |
| LESS: EXPENDITURE INCLUDING ADVANCES | 295.67 | 434.35 |
| NET AMOUNT AVAILABLE AS PER APPENDIX III ATTACHED | 408.28 | 348.45 |
| (D) FUNDS FOR PLAN PROJECTS | | |
| AS PER LAST BALANCE SHEET | 2,891.42 | - |
| ADD: RECEIVED DURING THE YEAR | 150.00 | 3,015.00 |
| TOTAL FUNDS AVAILABLE | 3,041.42 | 3,015.00 |
| LESS: EXPENDITURE INCLUDING ADVANCES | 1,294.08 | 123.58 |
| NET AMOUNT AVAILABLE AS PER APPENDIX IV ATTACHED | 1,747.34 | 2,891.42 |
| TOTAL (A+B+C+D) | 3,630.36 | 4,771.80 |

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Schedules Forming Part of Balance Sheet as on 31st March 2017

(Rs. in Lakhs)

| PARTICULARS | AS ON 31-03-2017 | AS ON 31-03-2016 |
|---|---------------------|---------------------|
| SCHEDULE NO. 7: CURRENT LIABILITIES & PROVISIONS | | |
| SUNDRY CREDITORS | 1,130.11 | 194.34 |
| BANK OVERDRAFT | - | 151.79 |
| ADVANCES RECEIVED TOWARDS SPONSORED PROJECTS AND TESTING | 1,469.53 | 1,064.85 |
| OTHER LIABILITIES- | | |
| EMPLOYEE INCENTIVE | 3,497.03 | 3,467.83 |
| UNPAID EARNED LEAVE BALANCES/LEAVE ENCASHMENT | 1,390.57 | 1,018.33 |
| INTEREST PAYABLE TO GOVERNMENT | 347.82 | 173.61 |
| PROVISION OF BILLS/EXPENSES | 847.25 | 731.40 |
| DEPOSITS RECEIVED FROM CUSTOMERS | 278.16 | 277.16 |
| DUTIES & TAXES | 13.44 | 52.80 |
| GRATUITY LIABILITY | 776.15 | 1.30 |
| OTHERS | 268.38 | 78.56 |
| TOTAL | 10,018.46 | 7,211.97 |
| SCHEDULE NO. 8: FIXED ASSETS | | |
| GROSS BLOCK | 67,548.17 | 41,930.63 |
| LESS: ACCUMULATED DEPRECIATION | 22,953.77 | 19,921.88 |
| NET BLOCK | 44,594.40 | 22,008.75 |
| CWIP | 5,351.48 | 25,669.62 |
| TOTAL | 49,945.88 | 47,678.37 |
| SCHEDULE NO. 9(A): INVENTORIES | | |
| INVENTORIES | | |
| - FUEL | 35.32 | 29.21 |
| TOTAL | 35.32 | 29.21 |
| SCHEDULE NO. 9(B): SUNDRY DEBTORS | | |
| UNSECURED, CONSIDERED GOOD, UNLESS STATED OTHERWISE | | |
| OUTSTANDING FOR A PERIOD EXCEEDING SIX MONTHS | 408.91 | 311.01 |
| OTHER DEBTS | 2,767.43 | 3,181.13 |
| CONSIDERED DOUBTFUL | 67.63 | 40.50 |
| LESS: PROVISION | 67.63 | 40.50 |
| TOTAL | 3,176.34 | 3,492.14 |

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Schedules Forming Part of Balance Sheet as on 31st March 2017

(Rs. in Lakhs)

| PARTICULARS | AS ON 31-03-2017 | AS ON 31-03-2016 |
|--|---------------------|---------------------|
| SCHEDULE NO. 9(C): DEPOSITS, CASH & BANK BALANCES | | |
| CASH IN HAND | 1.34 | 3.38 |
| BANK BALANCES WITH SCHEDULED BANKS | 9,564.27 | 402.75 |
| FIXED DEPOSITS WITH SCHEDULED BANKS | | |
| - EARMARKED | 22,916.39 | 33,514.38 |
| - OTHERS | 23,562.17 | 14,543.24 |
| TOTAL | 56,044.16 | 48,463.75 |
| SCHEDULE NO. 9(D): ADVANCES | | |
| STAFF ADVANCES | 15.79 | 11.68 |
| ADVANCE AGAINST CAPITAL EXPENDITURE | 42.88 | 28.33 |
| PREPAID EXPENSES | 67.71 | 31.04 |
| ADVANCES TO SUPPLIERS AND OTHERS | 979.76 | 365.57 |
| CLAIMS RECEIVABLE | | |
| (A) SERVICE TAX | 70.69 | 44.08 |
| (B) INCOME TAX | 683.49 | 566.69 |
| (C) VAT | 16.13 | 13.38 |
| OTHER ASSETS | 234.70 | 352.06 |
| TOTAL | 2,111.15 | 1,412.83 |
| SCHEDULE NO. 9(E): SUNDRY DEPOSITS | | |
| DEPOSIT WITH PMC | - | 0.04 |
| DEPOSIT WITH MSEDCL | 234.38 | 234.38 |
| DEPOSITS FOR TELEPHONE AND TELEX | 0.47 | 0.50 |
| DEPOSITS WITH GAS AGENCIES | 1.54 | 1.41 |
| DEPOSIT WITH MPCB | 3.75 | 3.75 |
| DEPOSIT WITH MIDC, CHAKAN | 6.62 | 6.62 |
| OTHER DEPOSITS | 10.70 | 9.03 |
| TOTAL | 257.46 | 255.73 |

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Schedules Forming Part of Income & Expenditure Account for the Year Ended 31st March 2017

(Rs. in Lakhs)

| PARTICULARS | YEAR ENDED 31-03-2017 | YEAR ENDED 31-03-2016 |
|---|--------------------------|--------------------------|
| SCHEDULE NO. 10: SPONSORED PROJECTS ,TESTING, LEARNING & TRAINING CENTRE | | |
| SPONSORED PROJECTS | 6,686.83 | 5,382.46 |
| DEVELOPMENT TESTING | 5,091.87 | 4,780.60 |
| CERTIFICATION TESTING | 11,929.10 | 10,034.33 |
| ROUTINE TESTING & TRAINING | 317.21 | 355.78 |
| LEARNING & TRAINING CENTRE | 589.66 | 561.48 |
| TOTAL | 24,614.67 | 21,114.65 |
| SCHEDULE NO.11: INTEREST | | |
| RECEIVED | 1,510.60 | 2,111.54 |
| ACCRUED | 1,263.70 | 1,754.10 |
| TOTAL | 2,774.30 | 3,865.64 |
| SCHEDULE NO.12: OTHER INCOME | | |
| PROVISION WRITTEN BACK- | | |
| (A) INCENTIVE | 137.34 | 63.06 |
| (B) GRATUITY | - | 131.13 |
| (C) DOUBTFUL DEBTS | 40.51 | 26.03 |
| FOREIGN EXCHANGE FLUCTUATIONS | 1.41 | - |
| SALE OF SCRAP | 61.16 | 64.49 |
| LIABILITIES NO LONGER PAYABLE | 25.37 | - |
| MISCELLANEOUS INCOME | 23.29 | 43.18 |
| KNOWLEDGE CENTRE | 5.94 | 9.75 |
| TOTAL | 295.02 | 337.64 |
| SCHEDULE NO.13: SALARIES & OTHER ALLOWANCES | | |
| SALARIES & ALLOWANCES | 9,975.04 | 8,517.54 |
| EMPLOYER'S CONTRIBUTION TO PROVIDENT FUND | 544.93 | 422.65 |
| EMPLOYER'S CONTRIBUTION TO SUPERANNUATION FUND | 448.73 | 316.08 |
| GRATUITY EXPENSES | 814.65 | - |
| LEAVE TRAVEL CONCESSION | 26.39 | 22.98 |
| TOTAL | 11,809.74 | 9,279.25 |

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Schedules Forming Part of Income & Expenditure Account for the Year Ended 31st March 2017

(Rs. in Lakhs)

| PARTICULARS | YEAR ENDED 31-03-2017 | YEAR ENDED 31-03-2016 |
|--|--------------------------|--------------------------|
| SCHEDULE NO.14 OPERATION & ESTABLISHMENT EXPENSES | | |
| ELECTRICITY CHARGES | 1,658.53 | 1,267.96 |
| REPAIRS & MAINTENANCE | 253.54 | 193.83 |
| RATES & TAXES | 92.28 | 109.11 |
| TRAVELLING & CONVEYANCE | 71.89 | 71.44 |
| TRANSPORT CHARGES | 4.40 | 7.49 |
| COMMUNICATION EXPENSES | 50.74 | 47.00 |
| INSURANCE CHARGES | 29.20 | 22.38 |
| FOREIGN EXCHANGE FLUCTUATIONS | - | 54.50 |
| PRE-OPERATIVE EXPENSES FOR NATRIP PROJECTS | - | 175.11 |
| INTEREST PAID | 8.82 | 0.03 |
| BANK CHARGES | 5.39 | 6.13 |
| MARKETING EXPENSES | 77.97 | 61.47 |
| LOSS ON SALE OF ASSET | 15.95 | 7.52 |
| PROVISION FOR DOUBTFUL DEBTS | 67.63 | 40.50 |
| BAD DEBTS AND CLAIMS WRITTEN OFF | 99.08 | 20.79 |
| AUDIT FEES | 1.50 | 1.41 |
| LEGAL AND PROFESSIONAL FEES | 90.47 | 58.61 |
| PROVISION FOR CORPORATE SOCIAL RESPONSIBILITY | 58.45 | 51.95 |
| PRINTING & STATIONERY | 21.83 | 17.77 |
| BOOKS & PERIODICALS | 33.67 | 35.21 |
| EXTERNAL LABOUR/SECURITY AND STIPEND ETC. | 526.53 | 389.26 |
| ISO 9000/TUV CERTIFICATION EXPENSES | 2.07 | 5.66 |
| SIX SIGMA EXPENSES | 0.99 | 0.20 |
| NABL ACCREDITATION EXPENSES | 7.19 | 0.69 |
| WP 29 EXPENSES | 21.19 | 29.41 |
| TRAINING AND SEMINAR EXPENSES | 32.39 | 28.66 |
| RECRUIMENT EXPENSES | 1.03 | 1.72 |
| SUBSCRIPTION | 1.43 | 2.74 |
| WATER CHARGES | 30.44 | 21.38 |
| MISCELLANEOUS EXPENSES | 131.29 | 159.17 |
| TOTAL | 3,395.91 | 2,889.10 |

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Schedule No. 15 Notes to the Accounts

I. SIGNIFICANT ACCOUNTING POLICIES:

1) Accounting Convention:

The financial statements have been prepared under the historical cost convention, having due regards to fundamental accounting assumptions of going concern, consistency and accrual, in compliance with the accounting standards issued by the Institute of Chartered Accountants of India.

2) Fixed Assets:

The Association has been adopting uniform policy as regards to capitalisation of assets acquired under Cess, NATRiP, Plan and Sponsored Projects, and own funds from 2004-05. Attributable finance costs and expenses of bringing the respective assets to working condition for their intended use are capitalised.

Group of Buildings & Roads include Air-conditioning systems, electrical fittings and other infrastructural facilities, which are integral part of building and are depreciated as per useful economic life.

• Intangible Assets:

Knowledge gathered by the Association (solely or jointly with the sponsor) in the form of Patents during the execution of sponsored projects which are capable of being registered with the Patent Authority are capitalized at the nominal value of Re. 1 per patent as an intangible asset. Computer software has also been classified under intangible assets.

• Impairment:

The carrying amount of cash generating units / assets is reviewed at balance sheet date to determine whether there is any indication of impairment. If any such indication exists, the recoverable amount is estimated as the higher of net selling price and value in use. Impairment loss is recognised whenever carrying amount exceeds the recoverable amount. Conversely, previously recognised losses are reversed when the estimated recoverable amount exceeds the carrying amount.

3) Depreciation:

a. Depreciation rates have been determined on the basis of estimated useful life of the Fixed Assets

and provided on written down value method from the year of their capitalization, including assets created out of government grants and various UNDP equipment received as grant-in-aid in kind.

Depreciation on the assets acquired out of the grants and various UNDP equipments is drawn back from General Fund and credited to Income & Expenditure Account.

b. As decided in the Meeting of the Committee for Depreciation Policy for ARAI held on 11th December 2013 depreciation rates have been revised from financial year 2013-14. The revised rates are as follows:

| BUILDING & ROADS ETC | | |
|------------------------------|---------------------------------|--------|
| 1. | BUILDING | 4.87% |
| 2. | ROADS | 25.89% |
| 3. | WATER PUMPS & PIPELINE | 18.10% |
| 4. | ELECTRICAL INSTALLATION | 18.10% |
| 5. | COOLING TOWERS | 18.10% |
| PLANT & MACHINERY | | |
| 6. | PLANT & MACHINERY | 9.50% |
| 7. | LAB & TESTING EQUIPMENT | 9.50% |
| 8. | MEASURING INSTRUMENTS-8 YEARS | 31.23% |
| 9. | MEASURING INSTRUMENTS- 15 YEARS | 18.10% |
| 10. | MEASURING INSTRUMENTS- 25 YEARS | 11.29% |
| 11. | TEST RIGS | 9.50% |
| 12. | TEST BEDS | 9.50% |
| 13. | CRANE | 9.50% |
| UNDP EQUIPMENT RECD. IN KIND | | |
| 14. | UNDP EQUIPMENT RECD. IN KIND | 9.50% |
| FURNITURE & FIXTURES | | |
| 15. | FURNITURE & FIXTURES | 25.89% |
| OFFICE EQUIPMENTS | | |
| 16. | OFFICE EQUIPMENTS | 45.07% |
| COMPUTERS & PERIPHERALS | | |
| 17. | COMPUTERS & PERIPHERALS | 63.16% |
| 18. | SERVERS | 39.30% |
| VEHICLES | | |
| 19. | VEHICLES | 39.30% |
| AIR-CONDITIONERS | | |
| 20. | AIR-CONDITIONERS | 25.89% |
| INTANGIBLE ASSETS | | |
| 21. | COMPUTER SOFTWARE | 45.07% |

- c. The Association provides full depreciation on the assets sold/scrapped in the second half of the financial year and at half of the rate for assets sold/scrapped in the first half of the financial year.

4) Government Grants:

The Association is showing the cost of asset acquired out of the Grants received at gross value and amount of grant received to the extent of Fixed Assets purchased is credited to General Fund A/c. With effect from financial year 2004-05, General Fund A/c is reduced to the extent of depreciation charged on such assets acquired out of the grants received.

5) Inventories:

- a. Inventory is valued at lower of cost or net realisable value. Stock of fuel is determined at Weighted Average cost.
- b. In view of the technical complications involved in valuation of partly completed sponsored projects, cost incurred is debited to Income & Expenditure Account.
- c. Consumable stores and spares are expensed upon purchases.

6) Foreign Exchange Transactions:

Transactions in foreign currency are recorded at the exchange rates prevailing on the date of transaction. The outstanding amounts denominated in foreign currency are shown at rates prevailing on the Balance Sheet date. The difference between the rate prevailing on the date of transaction and on the date of settlement is recognized as income or expense.

7) Revenue Recognition :

a. R&D- Sponsored Projects & Development Testing

Revenue is recognised based on specific contracts, either on association's specific benchmark or on achieving of specific results.

b. Other testing:

Revenue is recognised as and when service is rendered.

c. Membership Subscription

Revenue is recognised on accrual basis based on preceding year's turnover of member companies.

d. Symposium on International Automotive Technology (SIAT)

SIAT is an International event organized biannually to share knowledge and innovative ideas in Automotive Technology. Income is recognised on accrual basis in form of Delegate fees, Sponsorships, advertisements and stalls.

e. Learning Centre / Training Centre

Fees received are accounted on accrual basis.

f. Interest

Interest is recognized on accrual basis.

g. Training

These are the training sessions organized for industry. Income is recognized on completion of service performance.

h. Automotive material and manufacturing(AMM)

AMM is an International event initiated and organized to share knowledge and innovative ideas in Material and Manufacturing. Income is recognized on accrual basis in form of Delegate fees, Sponsorships, advertisements and stalls.

8) Employee Benefits

a. Defined Contribution Plan:

Association's contributions paid/payable during the year to Approved Superannuation Fund, Provident Fund are recognised in Income & Expenditure Account when contributions to respective funds are due. There are no other obligations other than the contribution payable to the respective trusts.

In respect of Provident Fund, the shortfall in respect of interest, if any, is made good by the association and is recognized as expense.

b. Compensated Absences:

Short term compensated Absences are provided for based on estimate. Long term compensated absences are provided for on the basis of actuarial valuation by using Projected Unit Credit Method (PUCM).

Actuarial gains and losses arising on such valuation are recognised immediately in Income & Expenditure account.

c. Leave Travel Concession:

Expenditure on Leave Travel Concession is paid as per block years basis as specified in the Leave Travel Concession Rules.

d. Defined Benefit Plan:

Association's liability towards gratuity is determined using the projected unit credit method which considers each period of service as giving rise to an additional unit of benefit entitlement and measures each unit separately to build up the final obligation. Past Service Gratuity Liability is computed with reference to the service put in by each employee till the date of valuation as also the projected terminal salary at the time of exit. Actuarial gain or losses are recognized immediately in the Statement of Income & Expenditure as income or expense. Obligation is measured at the present value of estimated future Cash Flow using a discount rate that is determined by reference to market yields at the Balance Sheet date on government bonds where the currency and terms of the government bonds are consistent with the currency and estimated terms of the defined benefit obligation.

9) Bad debts/Reserve for doubtful debts:

- a) For debtors outstanding for the period between 1-3 years 20% amount of receivables has been provided as Reserve for Doubtful debts.
- b) Debtors outstanding for more than 3 years are written off as bad debts.

10) Others

A. In the 115th Governing Council meeting held on 28-8-98, it was decided to set up the following funds:

i. Replacement of equipment/machinery Fund:

This fund was set up by earmarking specific investments corresponding to the amount of depreciation for the year. The interest earned from the earmarked investments is specifically set aside towards financing replacements of equipment and machinery and to meet ARAI's periodic capital expenditure other than projects.

ii. R & D Reserve Fund:

The surplus from the Income & Expenditure Account is transferred to the credit of this fund, to be invested in appropriate deposits as per approved norms. The interest earned thereon is to be set aside and exclusively used for ARAI's research projects not involving procurement of capital equipment.

B. However, in the 158th Governing Council meeting held on 5th June, 2009 it was decided as under:

From the financial year 2008-09 depreciation for the year and the amount of surplus/deficit for the year will not be transferred to respective funds. The amount of surplus will be transferred to General Fund and no fresh investments will be made.

I. Further, it has been decided to utilize these funds as under:

i. Replacement of equipment/machinery Fund:

The accumulated balance in the Replacement of equipment/machinery fund is to be used for ARAI Capital expenditure.

ii. R & D Reserve Fund:

The accumulated balance in the R & D Reserve fund is to be used for meeting expenditure on internal R&D projects (both revenue & capital). During the current year expenditure amounting to Rs. 66.33 Lakhs (Previous Year Rs.64.68

Lakhs) on ARAI R&D projects has been transferred from this fund to the income and expenditure account.

II. Contingent Liability

Bank Guarantees given by the Association:

The liability of the Association towards Bank Guarantees given as on 31.03.2017 is Rs.24.63 Lakhs (Previous Year Rs.22.00 Lakhs).

III. Capital Commitments

Estimated amount of contracts remaining to be executed on capital account (net of advances paid), not provided for is Rs 5 Lakhs (Previous Year Rs.339.55 lakhs)

Estimated amount of contracts remaining to be executed on Cess Projects (net of amount spent), is Rs. 736.36 Lakhs (Previous Year Rs. 209.15 Lakhs)

IV. CLASSIFICATION OF ASSETS :

a. Funds for Cess Projects : Department of Heavy Industry (DHI)

During the year, a sum of Rs. 1495.00 Lakhs (Previous Year Rs.2336.50 Lakhs) has been received from Ministry of Heavy Industries & Public Enterprises for approved projects of the Development Council for Automobile & Allied Industries from the Cess on automobiles. The amount so received has been credited to 'Funds for Cess Projects (DHI)' account and the payments made during the year on these approved projects have been debited to the said account. The balance Rs.1474.75 Lakhs (Previous Year Rs.1523.54 Lakhs) representing unspent funds to be utilized later is disclosed separately in the Balance Sheet.

The interest earned on unspent Cess funds is accounted as payable to the Government as per the terms and conditions of Funds sanctioned.

An amount of Rs. 10.00 Lakhs (Previous Year Rs.0.00 Lakhs) has been contributed by ARAI towards partly funded Cess projects, which have been debited to General Fund.

b. Funds for National Automotive Testing and R & D Infrastructure Project (NATRIIP) Projects:

During the year, a sum of Rs.0.00 Lakhs (Previous Year Rs. 0.00 Lakhs) has been received from NATRIIP. Payments made during the year on these approved projects have been debited to 'Funds for NATRIIP Projects account'. The balance Rs.0.00 Lakhs (Previous Year Rs.8.39 Lakhs) representing unspent funds to be utilized later is disclosed separately in the Balance Sheet.

The interest earned on unspent NATRIIP funds is accounted as payable to the Government as per the terms and conditions of Funds sanctioned.

An amount of Rs.250.87 Lakhs (Previous Year Rs. 1363.50 Lakhs) has been contributed by ARAI towards NATRIIP Projects during the year.

c. Funds for Inspection Maintenance Project Cell (IMPC)

During the year, a sum of Rs.355.50 Lakhs (Previous Year Rs. 481.06 Lakhs) has been received from Ministry of Road Transport & Highways (MVL Section). Payments made during the year on these approved projects have been debited to 'Funds for IMPC Projects account'. The balance Rs.408.28 Lakhs (Previous Year Rs.348.45 Lakhs) representing unspent funds to be utilized later is disclosed separately in the Balance Sheet.

The interest earned on unspent IMPC funds is accounted as payable to the Government as per the terms and conditions of Funds sanctioned.

d. Funds for Plan Projects

During the year, a sum of Rs.150.00 Lakhs (Previous Year Rs. 3015.00 Lakhs) has been received from Ministry of Heavy Industries & Public Enterprises for approved projects of the Development Council for Automobile & Allied Industries. Payments made during the year on these approved projects have been debited to 'Funds for PLAN Projects account'. The balance Rs.1747.34 Lakhs (Previous Year Rs.2891.42 Lakhs) representing unspent funds to be utilized later is disclosed separately in the Balance Sheet.

The interest earned on unspent PLAN funds is accounted as payable to the Government as per the terms and conditions of Funds sanctioned.

V. OTHER NOTES :

1. The stock has been physically verified by management during the year. The total stock of Fuel as on 31.3.2017 is valued at cost Rs. 35.32 Lakhs (Previous Year Rs.29.21 Lakhs)

2. Foreign Exchange Earnings:

The Foreign Exchange Earnings in 2016-2017 are as under::

(Rs. in Lakhs)

| Sr. No. | Particulars | F.Y. 2016-2017 | | | | F.Y. 2015-2016 | | | |
|---------|------------------------------|----------------|-------------|-------------|-------------------------|----------------|-------------|-------------|--------------------------|
| | | US \$ | EURO | GBP | Equivalent Amount in Rs | US \$ | EURO | GBP | Equivalent Amount in Rs. |
| 1 | Sponsored Projects & Testing | 12.25 | 4.76 | 0.05 | 1160.61 | 10.18 | 4.56 | 0.64 | 1039.50 |
| 2 | SIAT 2017 | 0.19 | - | - | 12.53 | - | - | - | - |
| | Total | 12.44 | 4.76 | 0.05 | 1173.14 | 10.18 | 4.56 | 0.64 | 1039.50 |

The above earnings are grouped under respective heads of income.

3. Learning Centre & Training Centre

The Association has entered into Understanding with various Reputed Institutes for conducting jointly Programme in Automotive Engineering, training Programs etc.

In the 174th meeting of the Governing Council of ARAI held on 20th February, 2013, it was decided to consider income of Learning Centre & Training Centre as operating income of ARAI from the financial year 2012-13. Hence income and expense of current year relating to learning center and training center is clubbed with sponsored project and testing income and expense. Accordingly, surplus of learning center and training center has not been transferred to general fund.

4. Employee Benefits

The Association has recognised following amounts in the Income and Expenditure Account for the year –

(Rs. in Lakhs)

| Sr. No. | Particulars | F.Y. 2016-17 Amount | F.Y. 2015-16 Amount |
|--------------------------------------|--|---------------------|---------------------|
| 1. Defined Contribution Plans | | | |
| i. | Contribution to Employees Provident Fund | 544.93 | 422.65 |
| ii. | Contribution to Superannuation Fund | 448.73 | 316.08 |

Compensated absences – as per Actuarial Valuation on March 31, 2017

- i) Reconciliation of opening and closing balances of the present value of the Defined Benefit Obligation (DBO):

(Rs. in Lakhs)

| Sr No | Particulars | F.Y. 2016-17 | F.Y. 2015-16 |
|-------|--|--------------|--------------|
| 1. | Opening Defined Benefit Obligation | 1018.33 | 869.07 |
| 2. | Current Service Cost | 571.25 | 320.58 |
| 3. | Benefits Paid | (199.01) | (171.32) |
| 4. | Closing Defined Benefit Obligation [(1+2-3)=4] | 1390.57 | 1018.33 |

ii. Gratuity – as per Actuarial Valuation on March 31, 2017

(Rs. in Lakhs)

| Statement showing changes in Present Value of obligations as on 31st March 2017 | March 31, 2017 | March 31, 2016 |
|---|----------------|----------------|
| Present value of obligations at the beginning of the year | 1390.51 | 1545.21 |
| Interest Cost | 106.18 | 118.23 |
| Past Service Cost | 529.03 | 0.00 |
| Current service cost | 107.65 | 65.41 |
| Benefits paid | (126.49) | (134.61) |
| Actuarial (gain)/loss on obligations | 173.44 | (203.73) |
| Present value of obligations as at the end of year | 2180.32 | 1390.51 |

| Table showing changes in the fair value of plan assets as on 31st March 2017 | March 31, 2017 | March 31, 2016 |
|--|----------------|----------------|
| Fair value of plan assets at the beginning of the year | 1418.49 | 1372.97 |
| Expected return on plan assets | 111.91 | 107.37 |
| Contributions | 2.48 | 73.00 |
| Mortality charges and taxes | (1.40) | 0.00 |
| Benefits paid | (126.49) | (134.61) |
| Actuarial gain/(loss) on obligations | (0.83) | (0.24) |
| Fair value of plan asset at end of year | 1404.17 | 1418.49 |

| Amounts to be recognised in the Balance Sheet | March 31, 2017 | March 31, 2016 |
|--|-----------------|----------------|
| Present Value of obligations as at the end of the year | 2180.32 | 1390.51 |
| Fair value of plan assets as at the end of the year | 1404.17 | 1418.49 |
| Surplus/(Deficit) | (776.15) | 27.98 |
| Net Asset/(Liability) recognised in balance sheet | (776.15) | 27.98 |

| Expenses recognised in statement of Income & Expenditure Account | March 31, 2017 | March 31, 2016 |
|---|----------------|-----------------|
| Current Service Cost | 107.65 | 65.41 |
| Past service cost | 529.03 | 0.00 |
| Interest Cost | 106.18 | 118.33 |
| Expected return on plan assets | (111.91) | 107.37 |
| Net Actuarial (gain)/Loss recognised during the year | 174.26 | (203.48) |
| Expenses/(Income) recognised in statement of Income & Expenditure | 805.21 | (127.21) |

| Percentage of each category of plan assets to total fair value of plan assets | March 31, 2017 | March 31, 2016 |
|---|----------------|----------------|
| Administered by LIC | 1404.17 | 1418.49 |
| Total | 1404.17 | 1418.49 |

| Actuarial Assumptions: | March 31, 2017 | March 31, 2016 |
|--------------------------|---|----------------|
| Discounted rate | 7.20%p.a. | 8.00%p.a. |
| Rate on return on assets | 8.25%p.a. | 8.00%p.a. |
| Salary escalation | 5.00%p.a. | 5.00%p.a. |
| Attrition rate | 2.00%p.a. | 2.00%p.a. |
| Mortality | Indian Assured Lives Mortality (2006-08) Ultimate | |

| | March 31, 2017 | March 31, 2016 |
|-------------------------------|----------------|----------------|
| Experience adjustments | | |
| On plan liability (gain)/loss | 173.44 | (203.72) |
| On plan asset gain/(loss) | (0.83) | 0.24 |

| Actuarial (Gain)/Loss recognized | March 31, 2017 | March 31, 2016 |
|--|----------------|----------------|
| Actuarial (gain)/Loss for the year – obligation | 173.44 | (203.72) |
| Actuarial (gain)/Loss for the year - plan assets | 0.83 | 0.24 |
| Total (gain)/Loss for the year | 174.26 | (203.49) |

- iii. Future salary increases considered in actuarial valuation take into account inflation, seniority, promotion and other relevant factors, such as supply and demand in the employment market.
5. Wherever information has been received from the Suppliers of their being Micro and Small Enterprises, amounts due to them are generally being paid in time. Hence no liability exists in respect of interest payable to Suppliers under Micro, Small and Medium Enterprises Development Act 2006 (MSMEDA).
6. Mails seeking confirmations for balances as on January 31, 2017 from suppliers and customers were dispatched by the association in Feb 2017. However, the replies have not been received in majority of the cases and therefore, their balances are reflected as appearing in the books of accounts.
7. ARAI has already been registered as a Society under Societies Registration Act, 1860. The application for registration under Bombay Public Trust Act was made by the Association on 21st April 2015 as per legal advice obtained in this matter. The Association received registration certificate under Bombay Public Trust Act on 12th April 2016.
8. Figures of the Previous Year have been restated and regrouped, wherever necessary, to confirm to the current year's classification.

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Statement of Receipts & Expenditure on Cess Projects

APPENDIX - I

(Rs. in Lakhs)

| Sr. No. | NAME OF THE PROJECT | PROJECT COST | RECEIPTS | | | EXPENDITURE | | | REFUNDED TO THE GOVT | AMOUNT BORNE BY ARAI 2016-17 | NET FUNDS AVAILABLE (6 - 9-10) |
|---------|--|-----------------|-----------------|-----------------|-----------------|-----------------|---------------|-----------------|----------------------|------------------------------|--------------------------------|
| | | | UPTO 2015-16 | 2016-17 | TOTAL (4 + 5) | UPTO 2015-16 | 2016-17 | TOTAL (7 + 8) | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 15 | 11 |
| 1 | Offline and Real time simulator for Electric Vehicle/Electric Vehicle Systems | 1155.83 | 1,156.00 | | 1156.00 | 1047.96 | 37.31 | 1085.27 | | | 70.73 |
| 2 | Material Compability & Emmision Performance with Ethanol Blended Gasoline (E20) | 331.00 | 295.00 | | 295.00 | 294.77 | | 294.76 | 0.24 | | 0.00 |
| 3 | Study of Multi-disciplinary approaches / challenges in light weighting / performance improvements with focus on design optimization of components,syst | 400.00 | 100.00 | 260.00 | 360.00 | 15.00 | 60.63 | 75.63 | | | 284.37 |
| 4 | Development of Advanced Low Temperature Diesel Combustion(LTC) System to achive Euro-V & Euro VI Emission with considered conversion efficiencies | 615.00 | 200.00 | 200.00 | 400.00 | 4.98 | 64.62 | 69.60 | | | 330.40 |
| 5 | Development of Duty Cycle of Public & Goods Transport Vehicle separately(Intercity bus & Truck application) & arrive guidelines for estimating Vehicle | 325.00 | 125.00 | 200.00 | 325.00 | 72.98 | 162.91 | 235.88 | | | 89.12 |
| 6 | Source apportionment of PM2.5 & PM10 of NCR for Identification of Major sources | 600.00 | 200.00 | 400.00 | 600.00 | 48.37 | 294.18 | 342.55 | | | 257.45 |
| 7 | Development of Lightweight Bus Prototype with Aluminium (AL) Superstructure for Indian City Application | 950.00 | 200.00 | 180.00 | 380.00 | 0.00 | 179.45 | 179.45 | | | 200.55 |
| 8 | Supercharging of Small (Single & Two Cylinder) Diesel Engines | 125.00 | 50.00 | 75.00 | 125.00 | 0.00 | 41.24 | 41.24 | | | 83.76 |
| 9 | Development of EV2 Wheeler Kit | 563.50 | 563.50 | | 563.50 | | | | 563.50 | | 0.00 |
| 10 | Study & Development & Lightweight Forging Process for Automotive Components. | 380.00 | 200.00 | 180.00 | 380.00 | 81.91 | 139.73 | 221.64 | | | 158.36 |
| 11 | Measurement of Wheel Forces of 4-Wheel Automotive Vehicles and Study of Their Corlation with Customer Usage Pattern | | | | | | 10.00 | 10.00 | | 10.00 | 0.00 |
| | TOTAL | 5,445.33 | 3,089.50 | 1,495.00 | 4,584.50 | 1,565.96 | 990.06 | 2,556.02 | 563.74 | 10.00 | 1,474.75 |
| | PREVIOUS YEAR | 5,929.33 | 3,573.50 | | 3,573.50 | 2,014.81 | | 2,017.81 | 35.14 | | 1,523.54 |

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Statement Showing the Receipts and Payments on Projects Funded by NARTRIP

(Rs. in Lakhs)

| SR. NO | NAME OF THE PROJECT | PROJECT COST | RECEIPTS | | | PAYMENTS | | | Expenses borne by ARAI 2015-16 | Expenses borne by ARAI 2016-17 | NET FUND AVAILABLE AS ON 31.03.2017 |
|--------|--|----------------|----------------|-------------|----------------|-----------------|---------------|-----------------|--------------------------------|--------------------------------|-------------------------------------|
| | | | UPTO 2015-2016 | 2016-2017 | TOTAL | UPTO 2015-2016 | 2016-2017 | TOTAL | | | |
| 1 | EXPANSION OF EXISTING FACILITIES AT SDL | 200.00 | 200.00 | 0.00 | 200.00 | 198.25 | 1.75 | 200.00 | 0.00 | 0.00 | |
| 2 | PROCUREMENT OF ENGINE TEST EQUIPMENTS / INSTRUMENTS FOR CELL C2 OF NEW EDL | 59.38 | 59.38 | 0.00 | 59.38 | 52.73 | 6.65 | 59.38 | 0.00 | 0.00 | |
| 3 | DEVELOPMENT OF CIVIL INFRASTRUCTURE UNDER NATRIP PROJECT | 5509.00 | 5509.00 | 0.00 | 5509.00 | 9601.66 | 202.77 | 9804.43 | 4092.66 | 211.17 | |
| 4 | DEPOSITORY WORK for PWT4-HVAC ARAI A/c. | 965.00 | 965.00 | 0.00 | 965.00 | 977.71 | 45.00 | 1022.71 | 12.71 | 45.00 | |
| | TOTAL | 6733.38 | 6733.38 | 0.00 | 6733.38 | 10830.36 | 256.17 | 11086.52 | 4105.37 | 256.17 | 0.00 |
| | PREVIOUS YEAR | 6733.38 | 6733.38 | | 6733.38 | 10830.36 | | 10830.36 | 1363.50 | | 8.39 |

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Statement Showing Receipts and Payments for Inspection Maintenance Project Cell for the Year 2016-2017

(Rs. in Lakhs)

| SR NO | NAME OF THE PROJECT | TOTAL PROJECT COST | ARAI PROJECT COST | RECEIPTS | | PAYMENTS | | TOTAL (8 + 9) | NET FUND AVAILABLE (7 - 10) | |
|-------|---|--------------------|-------------------|----------------|---------------|----------------|----------------|---------------|-----------------------------|---------------|
| | | | | UPTO 2015-16 | 2016-17 | UPTO 2015-16 | 2016-17 | | | |
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1 | SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT NASIK IN MAHARASHTRA | 1440.00 | 735.00 | 748.11 | 0 | 748.11 | 769.26 | 33.31 | 802.58 | -54.47 |
| 2 | SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT RAILMAGARA IN RAJASTHAN | 1440.00 | 735.00 | 746.55 | 0 | 746.55 | 682.87 | 10.57 | 693.45 | 53.10 |
| 3 | SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT NELMANGALA, BANGALORE DISTRICT IN KARNATAKA | 1440.00 | 730.00 | 755.80 | 0 | 755.80 | 683.43 | 45.29 | 728.72 | 27.08 |
| 4 | SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT MALKAPUR IN HYDERABAD DISTRICT IN ANDHRA PRADESH | 1440.00 | 65.00 | 41.31 | 28.75 | 70.06 | 23.03 | 28.75 | 51.78 | 18.27 |
| 5 | SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT OLPADA IN SURAT DISTRICT IN GUJARAT | 1440.00 | 65.00 | 41.38 | 28.75 | 70.13 | 28.65 | 28.75 | 57.40 | 12.72 |
| 6 | SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT CUTTACK IN ODISHA | 1540.00 | 835.00 | 208.00 | 188.00 | 396.00 | 5.44 | 148.77 | 154.21 | 241.79 |
| 7 | SETTING UP OF A MODEL INSPECTION & CERTIFICATION (I & C) CENTRE IN MALAPPURAM, KERALA | 1575.00 | 870.00 | 0 | 110.00 | 110.00 | 0 | 0.22 | 0.22 | 109.78 |
| | TOTAL | 10315.00 | 4035.00 | 2541.14 | 355.50 | 2896.64 | 2192.70 | 295.67 | 2488.37 | 408.28 |
| | PREVIOUS YEAR | 8740.00 | 3165.00 | 2541.14 | | 2541.14 | 2192.70 | | 2192.70 | 348.45 |

APPENDIX - III

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Statement of Receipts & Expenditure on Plan Projects

APPENDIX - IV

(Rs. in Lakhs)

| Sr. No. | NAME OF THE PROJECT | PROJECT COST | RECEIPTS | | | EXPENDITURE | | | REFUNDED TO THE GOVT | NET FUNDS AVAILABLE (6 - 9) |
|---------|---|-----------------|----------------|---------------|-----------------|---------------|-----------------|-----------------|----------------------|-----------------------------|
| | | | UPTO 2015-16 | 2016-17 | TOTAL (4 + 5) | UPTO 2015-16 | 2016-17 | TOTAL (7 + 8) | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 10 |
| 1 | Establishment of Testing Infrastructure for Certification Testing Of Electric & Hybrid Vehicles | 5000.00 | 3000.00 | | 3000.00 | 122.63 | 1293.43 | 1416.09 | | 1583.91 |
| 2 | Preparation for Specification & Finalising Draft Standards of XEV charging station | 15.00 | 15.00 | | 15.00 | 0.95 | 0.61 | 1.57 | | 13.43 |
| 3 | Development of XEV One Platform | 150.00 | 0.00 | 150.00 | 150.00 | 0.00 | 0.00 | 0.00 | | 150.00 |
| | TOTAL | 5,465.00 | 3015.00 | 150.00 | 3,015.00 | 123.58 | 1,294.08 | 1,417.66 | - | 1,747.34 |
| | PREVIOUS YEAR | 5,015.00 | 3015.00 | | 3,015.00 | 123.58 | | 123.58 | | 2,891.42 |

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Fixed Assets Schedule - From 1.4.2016 to 31.3.17

APPENDIX - V (Rs. in Lakhs)

| Particulars | GROSS BLOCK | | | DEPRECIATION | | | NET BLOCK | | |
|----------------------------------|------------------|---------------------------|----------------------------|------------------|----------------------------|--------------------------|----------------------|------------------|------------------|
| | As on 31-03-2016 | Additions during the year | Deductions during the year | As on 31-03-2016 | Deductions during the year | Provided during the year | Total upto 31.3.2017 | As on 31-03-2017 | As on 31-03-2016 |
| I. LAND | 2,345.75 | 13,153.83 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15,499.58 | 2,345.75 |
| A) FREE HOLD LAND | 1,193.62 | 13,153.83 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14,347.45 | 1,193.62 |
| B) LEASE HOLD LAND | 1,152.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1,152.13 | 1,152.13 |
| II. BUILDING & ROADS ETC. | 5,787.69 | 8,299.28 | 0.00 | 1,956.63 | 0.00 | 880.96 | 2,837.59 | 11,249.38 | 3,831.06 |
| III. PLANT & MACHINERY | 28,737.41 | 3,661.38 | 290.46 | 13,784.39 | 211.49 | 1,768.54 | 15,341.44 | 16,766.88 | 14,953.01 |
| IV. UNDP EQUIPMENT RECD. IN KIND | 276.84 | 0.00 | 0.50 | 246.20 | 0.49 | 2.34 | 248.05 | 28.29 | 30.65 |
| V. FURNITURE & FIXTURES | 543.50 | 25.50 | 569.00 | 381.03 | 45.83 | 426.86 | 162.48 | 142.15 | 162.48 |
| VI. OFFICE EQUIPMENTS | 283.34 | 110.87 | 392.05 | 239.28 | 1.91 | 62.46 | 299.84 | 92.22 | 44.06 |
| VII. COMPUTER & PERIPHERALS | 1,319.78 | 138.47 | 8.68 | 1,196.39 | 8.65 | 125.91 | 1,313.65 | 135.91 | 123.39 |
| VIII. VEHICLES | 547.00 | 55.21 | 27.02 | 354.77 | 21.73 | 87.71 | 420.75 | 154.45 | 192.23 |
| IX. AIR-CONDITIONERS | 476.55 | 170.21 | 16.64 | 388.94 | 15.66 | 66.54 | 439.83 | 190.29 | 87.61 |
| X. INTANGIBLE ASSETS | 1,612.76 | 348.26 | 0.00 | 1,374.25 | 0.00 | 251.53 | 1,625.78 | 335.25 | 238.51 |
| Total | 41,930.63 | 25,963.01 | 345.46 | 19,921.88 | 259.93 | 3,291.83 | 22,953.79 | 44,594.39 | 22,008.75 |
| CAPITAL WORK IN PROGRESS | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5,351.48 | 25,669.62 |
| GRAND TOTAL | 41,930.63 | 25,963.01 | 345.46 | 19,921.88 | 259.93 | 3,291.83 | 22,953.79 | 49,945.86 | 47,678.37 |
| PREVIOUS YEAR GROSS TOTAL | 39,371.37 | 3,254.45 | 695.18 | 17,712.92 | 339.82 | 2,548.78 | 19,921.88 | 47,678.37 | 44,291.95 |

* EQUIPMENTS OF Rs. 3456.05 lakhs received from NATRIP are not included in the balance as on 31.03.2016 under Gross Block and Rs. 458.57 Lakhs not included in the balance as on 31.03.2016 in Depreciation

** EQUIPMENTS OF Rs. 10828.35 lakhs received from NATRIP are not included in additions during the year and Rs. 733.99 Lakhs not included in Depreciation provided during the year

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Fixed Assets Schedule - 2016-2017 (Assets Procured Out of Government Funds)

| Particulars | GROSS BLOCK | | | | DEPRECIATION | | | | NET BLOCK | |
|---------------------------------|------------------|------------------|-------------------|------------------|------------------|-------------------|--------------------------|----------------------|------------------|------------------|
| | As on 31-03-2016 | Additions during | Deductions during | As on 31-03-2017 | As on 31-03-2016 | Deductions during | Provided during the year | Total upto 31.3.2017 | As on 31-03-2017 | As on 31-03-2016 |
| I. LAND | 20.92 | 0.00 | 0.00 | 20.92 | 0.00 | 0.00 | 0.00 | 0.00 | 20.92 | 20.92 |
| II. BUILDING & ROADS ETC. | 3,677.35 | 6,108.82 | 0.00 | 9,786.17 | 1,538.98 | 0.00 | 415.37 | 1,954.35 | 7,831.83 | 2,138.37 |
| III. PLANT & MACHINERY | 17,833.96 | 2,250.83 | 262.24 | 19,822.56 | 9,855.26 | 199.39 | 867.03 | 10,522.90 | 9,299.65 | 7,978.70 |
| IV. UNDP EQUIPMENT RECD.IN KIND | 287.98 | 0.00 | 0.50 | 287.48 | 283.04 | 0.49 | 0.47 | 283.02 | 4.46 | 4.94 |
| V. FURNITURE & FIXTURES | 124.01 | 0.00 | 0.00 | 124.01 | 97.21 | 0.00 | 6.95 | 104.16 | 19.86 | 26.80 |
| VI. OFFICE EQUIPMENTS | 21.29 | 5.09 | 0.00 | 26.37 | 18.58 | 0.00 | 2.31 | 20.89 | 5.49 | 2.71 |
| VII. COMPUTER & PERIPHERALS | 304.48 | 1.29 | 0.85 | 304.93 | 301.21 | 0.85 | 2.03 | 302.39 | 2.54 | 3.27 |
| VIII. VEHICLES | 40.16 | 0.00 | 0.00 | 40.16 | 36.91 | 0.00 | 1.27 | 38.19 | 1.97 | 3.24 |
| IX. AIR-CONDITIONERS | 308.87 | 0.00 | 16.64 | 292.22 | 261.19 | 15.51 | 12.05 | 257.73 | 34.49 | 47.68 |
| X. INTANGIBLE ASSETS | 453.48 | 0.00 | 0.00 | 453.48 | 415.22 | 0.00 | 17.24 | 432.46 | 21.01 | 38.26 |
| TOTAL | 23,072.50 | 8,366.04 | 280.24 | 31,158.30 | 12,807.61 | 216.24 | 1,324.71 | 13,916.08 | 17,242.22 | 10,264.89 |
| CAPITAL WORK IN PROGRESS | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6,049.89 |
| GRAND TOTAL | 23,072.50 | 8,366.04 | 280.24 | 31,158.30 | 12,807.61 | 216.24 | 1,324.71 | 13,916.08 | 17,242.22 | 16,314.78 |
| PREVIOUS YEAR | 23,048.87 | 111.00 | 87.37 | 23,072.50 | 11,750.80 | 76.15 | 1,132.95 | 12,807.60 | 16,314.79 | 17,165.62 |

* EQUIPMENTS OF Rs.3456.05 lakhs received from NATRIP are not included in the balance as on 31.03.2016 under Gross Block and Rs.458.57 Lakhs not included in the balance as on 31.03.2016 in Depreciation

** EQUIPMENTS OF Rs.10828.35 lakhs received from NATRIP are not included in additions during the year and Rs.733.99 Lakhs not included in Depreciation provided during the year

ARAI Organisation Chart

RESEARCH & DEVELOPMENT DIVISION 1

Structural Dynamics Lab.;
Automotive Materials Lab.



Mr. M. R. Saraf
Senior Deputy Director
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Noise, Vibration &
Harshness Lab., CAE



Mr. N. V. Karanth
Senior Deputy Director
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RESEARCH & DEVELOPMENT DIVISION 2

Powertrain Engg.,
Prototype Mfg. Dept.



Mr. N. V. Marathe
Senior Deputy Director
nvmarathe.edl@araiindia.com

Automotive Electronics Dept.,
Information Technology
Management



Mr. A. A. Deshpande
Deputy Director
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Mrs. Rashmi Urdhwareshe
Director-ARAI
director@araiindia.com

HOMOLOGATION DIVISION

Vehicle Evaluation Lab.
Homologation Management
& Regulation



Mr. A. A. Badusha
Senior Deputy Director
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Safety & Homologation Lab.,
Passive Safety Lab.



Mr. A. V. Mannikar
Senior Deputy Director
mannikar.shl@araiindia.com

Emission Certification Lab.



Mr. K. Srinivas
Senior Deputy Director
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Homologation & Technology
Centre and FID, Chakan



Mr. S. S. Nibandhe
Deputy Director
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SERVICE DIVISION

Business Development &
Corporate Planning



Mr. N. B. Dhande
Senior Deputy Director
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Knowledge Centre



Dr. K. C. Vora
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Central Maintenance Cell



Mrs. M. S. Mainkar
Senior Deputy Director
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Human Resource Management
& Administration



Dr. M. V. Uchgaonkar
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Finance & Accounts,
Purchase, and Stores



Mr. A. B. Bhide
Deputy Director
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Quality Management Department,
Calibration Lab



Mr. V. K. Jadhav
General Manager
jadhav.gmd@araiindia.com

Infrastructure Development



Mr. C.S. Mukhedkar
General Manager
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Governing Council Secretariat



Mrs. P. M. Dhare
Deputy General Manager
Secretary to the Governing Council
dhare.acc@araiindia.com



NEW FACILITIES & CAPABILITIES

Battery Test System



Battery Emulator



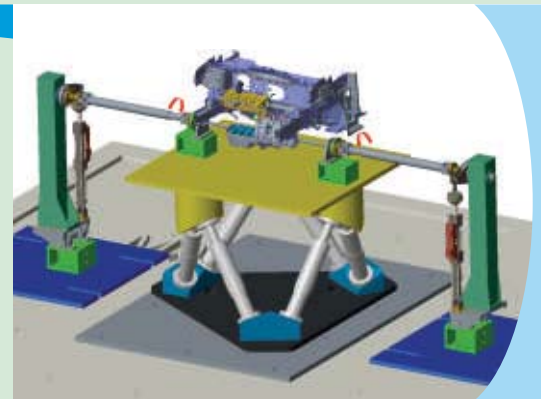
Gonio Photometer



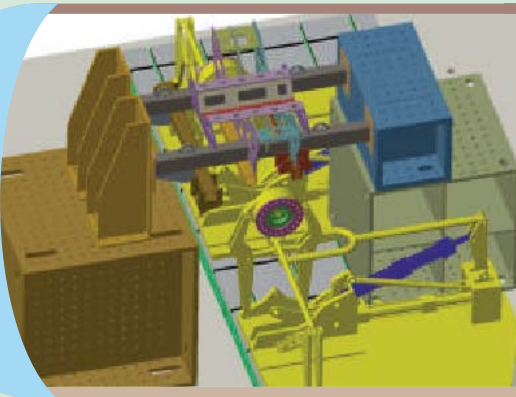
Transient Dynamometer



AWD SUV Engine and Gear Box Assembly using 8 & 9 DOF Multi-axis Technique



Suspension Evaluation using 4DOF Multi-axis Technique



Noise Measurement on Mining Machines



Laden Tests of Seating Systems





ARAI

Progress through Research

The Automotive Research Association of India
(Affiliated to Ministry of Heavy Industries & Public Enterprises, Govt. of India)

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