ARAI

Progress through Research

Journey Towards
Green Future

47th ANNUAL REPORT

2016-2017

The Automotive Research Association of India

ARAI

Progress through Research

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

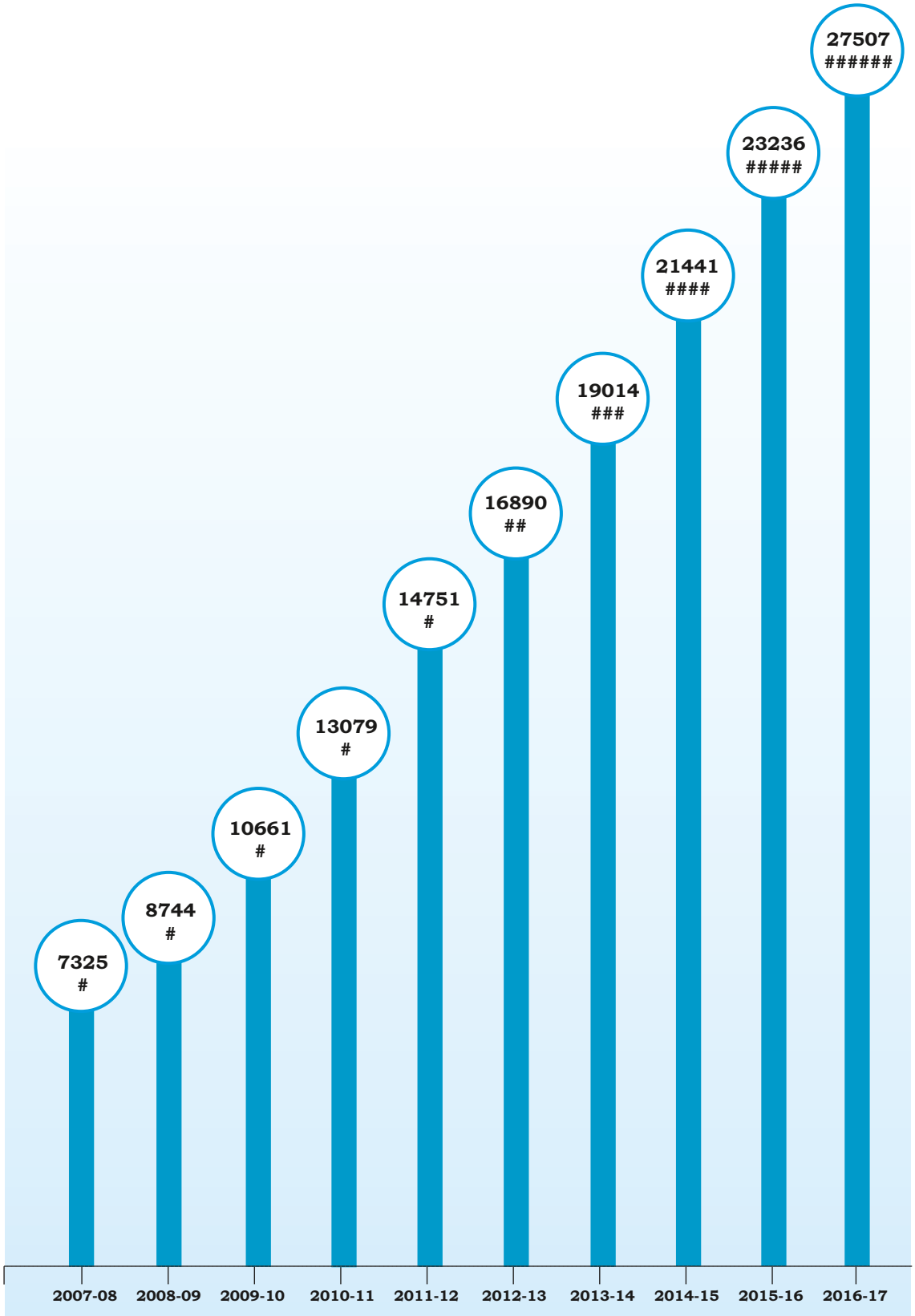
(e) to develop team spirit and sense of belonging amongst all.

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 worldover.
- 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

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

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. 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.

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.

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.

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.

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.

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.

Rajan Wadhera

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.

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.

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.

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

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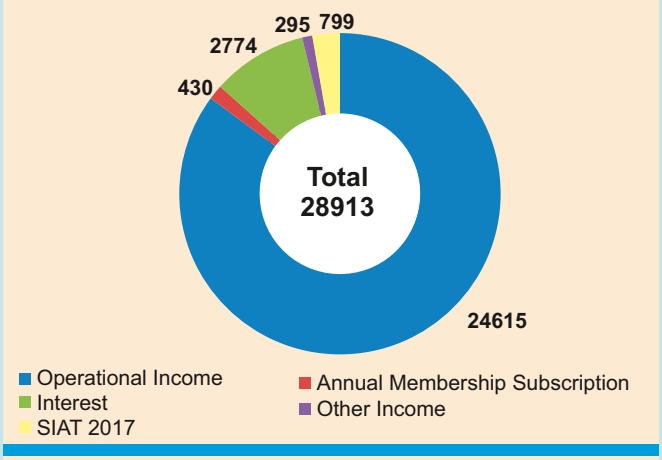
I am confident, our time-tested commitment to our values, underpins our ability to deliver long-term growth.

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.

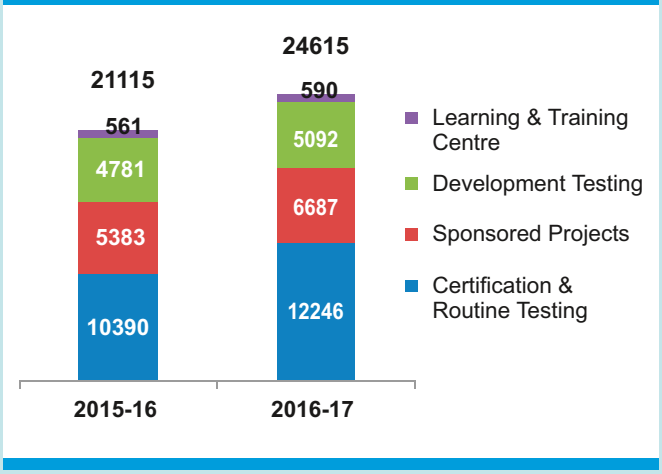
Mrs. Rashmi Urdhwareshe

Key Indicators : 2016-17

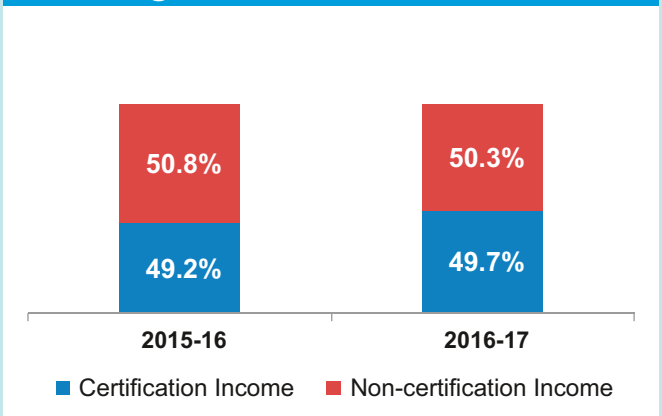
Income Profile (Rs. In Lakh)



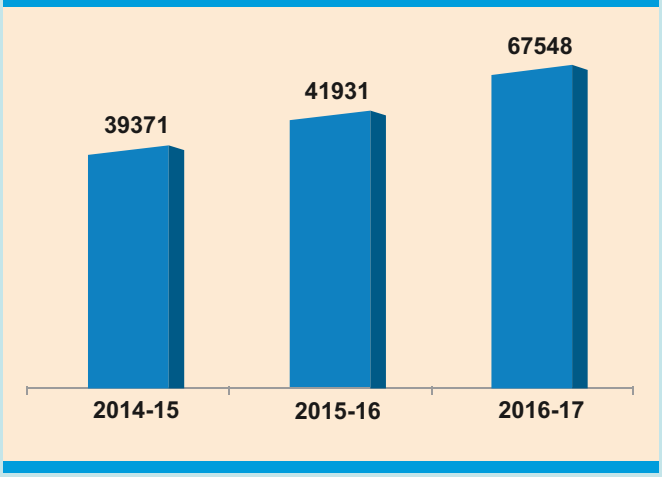
Operational Income (Rs. In Lakh)



Segment wise Contribution



Gross Block (Rs. In Lakh)



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 wtih 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,ISO14001,OHSAS18001, 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.

Overview of Operations

ARAI
Progress through Research

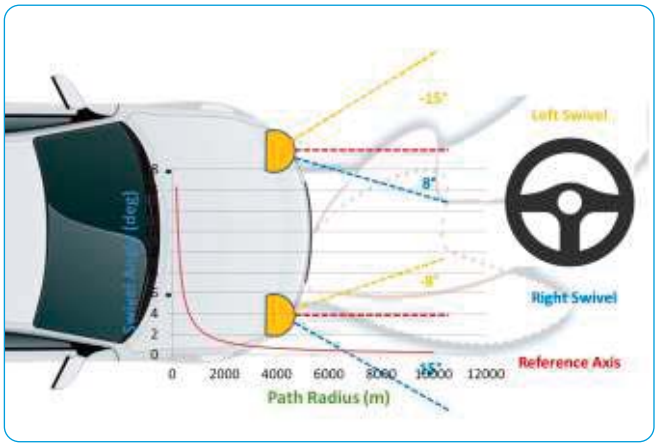
- Development and Testing Activities
- Human Resource Development
- Corporate Social Responsibility (CSR)
- Technology / Research Publications
- Business Development
- Events
- Knowledge Centre
- ARAI Homologation and Technology Centre (ARAI - HTC), Chakan

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.



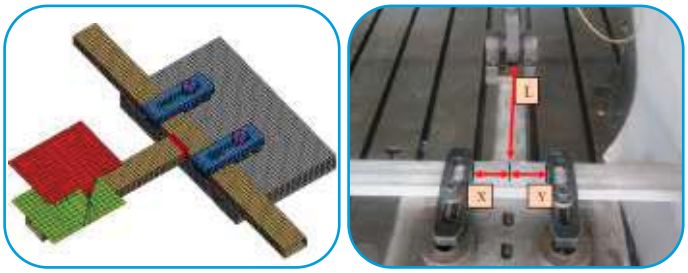
- Offline and Real-time Simulator for EV / HEV Systems

  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-IIIA 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

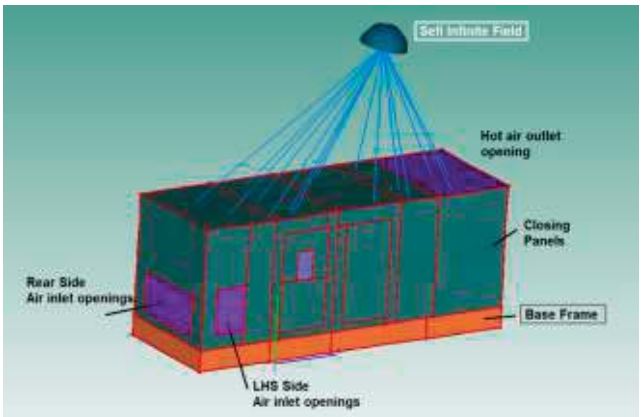
- Structural Strength Evaluation

  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.

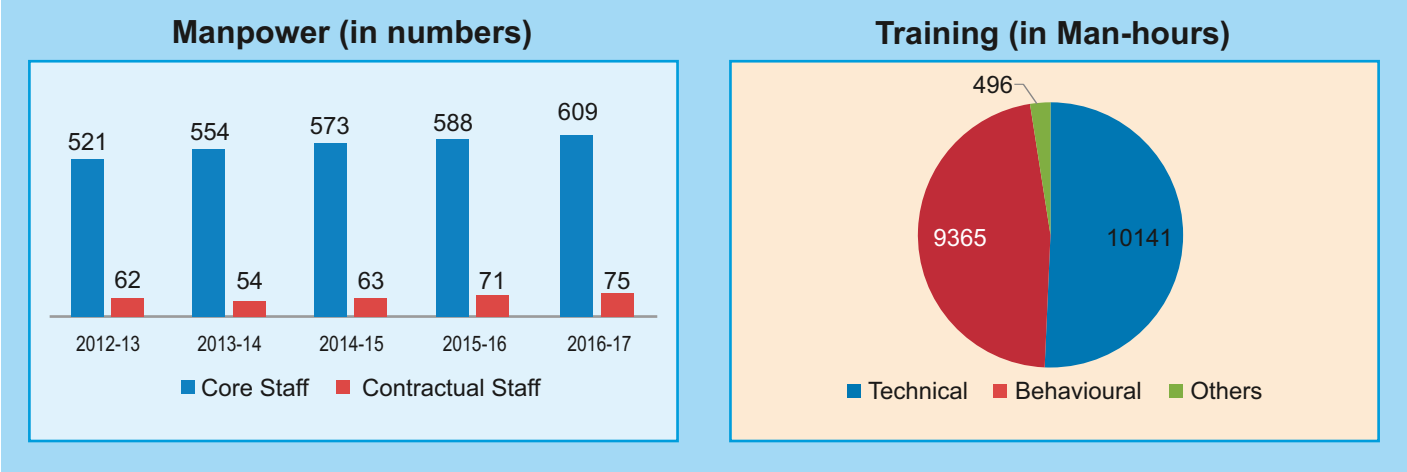
- Evaluation of Transmission, Rear Axle and Engine Oil

  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.



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 (SRSG). 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

SRSG 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 NOx 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 (IJAER) 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 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 wtih 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 form 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, Fleetgaurd 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 Bhave, 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 Urdhwareshe, 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)

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.

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

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

Contact Information:

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

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

ARAI Progress through Research

e-PIP on Reliability Engineering

Get Trained on the Latest Automotive Topics Anywhere, Anytime...

Become a certified professional with our EEMS course.

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.

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

Course Content:

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

Contact Information:

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

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

ARAI Progress through Research | BOSCH Invented for life

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

ARAI
Progress through Research

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 Urdhwareshe
Director

Rajan Wadhera
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	1,967.13	1,132.95	1,475.29
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 TRANSTERED 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 Wadhera
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

ARAI
Progress through Research

ARAI Organisation Chart

Mrs. Rashmi Urdhwareshe
Director-ARAI
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NEW FACILITIES & CAPABILITIES

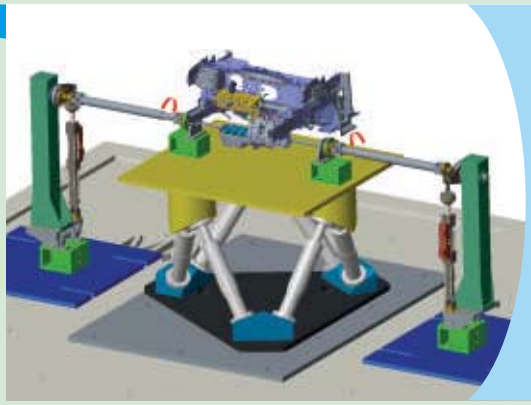
Battery Test System

Battery Emulator

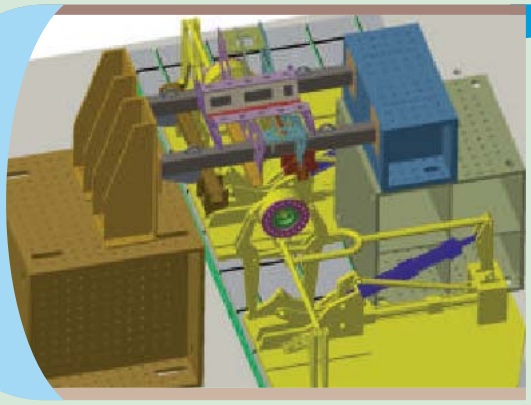
Gonio Photometer

Transient Dynamometer

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



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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