MIRDC
ANNUAL REPORT
2017

Strengthening Alliances | **F**orging Linkages | **T**ranscending Challenges | **P**rogressive M&E Industries

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MESSAGE FROM THE SECRETARY

The Department of Science and Technology (DOST) recognizes the Metals Industry Research and Development Center's (MIRDC) significant contribution to the achievement of DOST's vision of being the provider of world-class scientific, technological, and innovative solutions. The Country's march toward reaching the long-term goal of providing the Filipino a strongly rooted, comfortable, and secure life, it is imperative that the DOST is able to translate its programs and projects into maximum socio-economic benefits for the Filipinos through its R&D initiatives and S&T services.

Given the myriad of key areas to prioritize, the DOST is confident that the requirements of the metals, engineering, and allied industries are being effectively addressed through the initiatives of the MIRDC. The DOST likewise acknowledges the Center's efforts to sustain its strategic collaboration with industry.

I congratulate the men and women behind all MIRDC's achievements. The Center has the responsibility to continue to implement the most relevant projects, with the hope that these will eventually be transformed into technology transfer and commercialization agreements. With MIRDC's unyielding efforts, the vision of a science, technology, and innovation-driven nation poised for higher productivity and a better quality of life will be a reality.

Mabuhay!

FORTUNATO T. DELA PEÑA
Secretary, DOST
and Chairperson, MIRDC
Governing Council

mirdc

MESSAGE FROM THE EXECUTIVE DIRECTOR

With pride, I present to you the 2017 Annual Report of the Department of Science and Technology-Metals Industry Research and Development Center (DOST-MIRDC).

Our Annual Report is made up of an array of stories that tell about the Center's journey with the industry – our activities for the year 2017 and how these are instrumental in fostering mutually beneficial partnerships. We carried out relevant research and development undertakings and provided much needed technical services with the aim of promoting to the MSMEs the utilization of science, technology, and innovation to raise the bar and stimulate businesses to level up and become more productive and competitive. In doing so, the Center remains true to its commitment of being the industries' staunch ally. As depicted in this year's theme, 'Strengthening Alliances, Forging Linkages, and Transcending Challenges for a Progressive M&E Industries,' we are on-track with our shared goal of enhanced global competitiveness.

In 2017, the Center took some bold steps in order to tailor-fit our services to the ever-changing requirements of local industries. These are indications of the Center's responsiveness and commitment to meet the requirements of the M&E and allied industries. Through the accomplishments presented in the 2017 Annual Report, we mean to convey our earnest and strong desire to be the foremost partner to the industry we serve. We are one with our stakeholders in their approach to face and overcome changes and challenges.

ROBERT O. DIZON
Executive Director, MIRDC

VISION

Center of excellence in science, technology and innovation for a globally-competitive metals, engineering and allied industries by 2025.

CORE VALUES

Professionalism

We adhere to the highest ethical standards of performance.
We value our work and are committed to perform to the best of our ability.

Responsiveness

We spearhead implementation of projects that address the needs of the metals and engineering industries.
We find solutions to real-life problems through science, technology and innovation.

Integrity

We act responsibly, work honestly, and encourage transparency.

Dynamism

We perform our jobs with vigor and enthusiasm.
We welcome change as an opportunity for growth and continual improvement.

Excellence

We adhere to world-class performance and continuous improvement in all we do.
We always do our best in every task/endeavor.

MISSION

We are committed to provide both government and private sectors in the metals, engineering and allied industries with professional management and technical expertise on the training of engineers and technicians; information exchange; quality control and testing; research and development; technology transfer; and business economics and advisory services.

QUALITY & ENVIRONMENTAL POLICY

We are committed to provide products and services to both the government and the private sectors in the metals and engineering and allied industries with the highest standards of quality and reliability within our capabilities and resources and aligned to our strategic direction, to comply with applicable statutory and regulatory requirements, to plan and implement actions to address risks and opportunities and to continually improve the effectiveness of our Quality and Environmental Management Systems at all times in order to enhance customer satisfaction at all times.

We shall manage and control our activities in order to minimize adverse impacts on the environment, prevent pollution and safeguard the health and safety of all employees, stakeholders, customers, external providers and the surrounding community.

MFO 1 – RESEARCH and DEVELOPMENT

Being of relevant service to the metals, engineering, and allied industries is the reason why the Department of Science and Technology – Metals Industry Research and Development (DOST-MIRDC) exists. It is because of this purpose that the Center aggressively plunges into research and development activities, a commitment that has always motivated the Center to help bring out the best of the industries' creativity and innovativeness.

In 2017, the Center was able to successfully complete 39 R&D projects, which are an aggregate of internal projects, contract researches, and grant-in-aid.

Performance Testing and Evaluation of Prototype Trainset

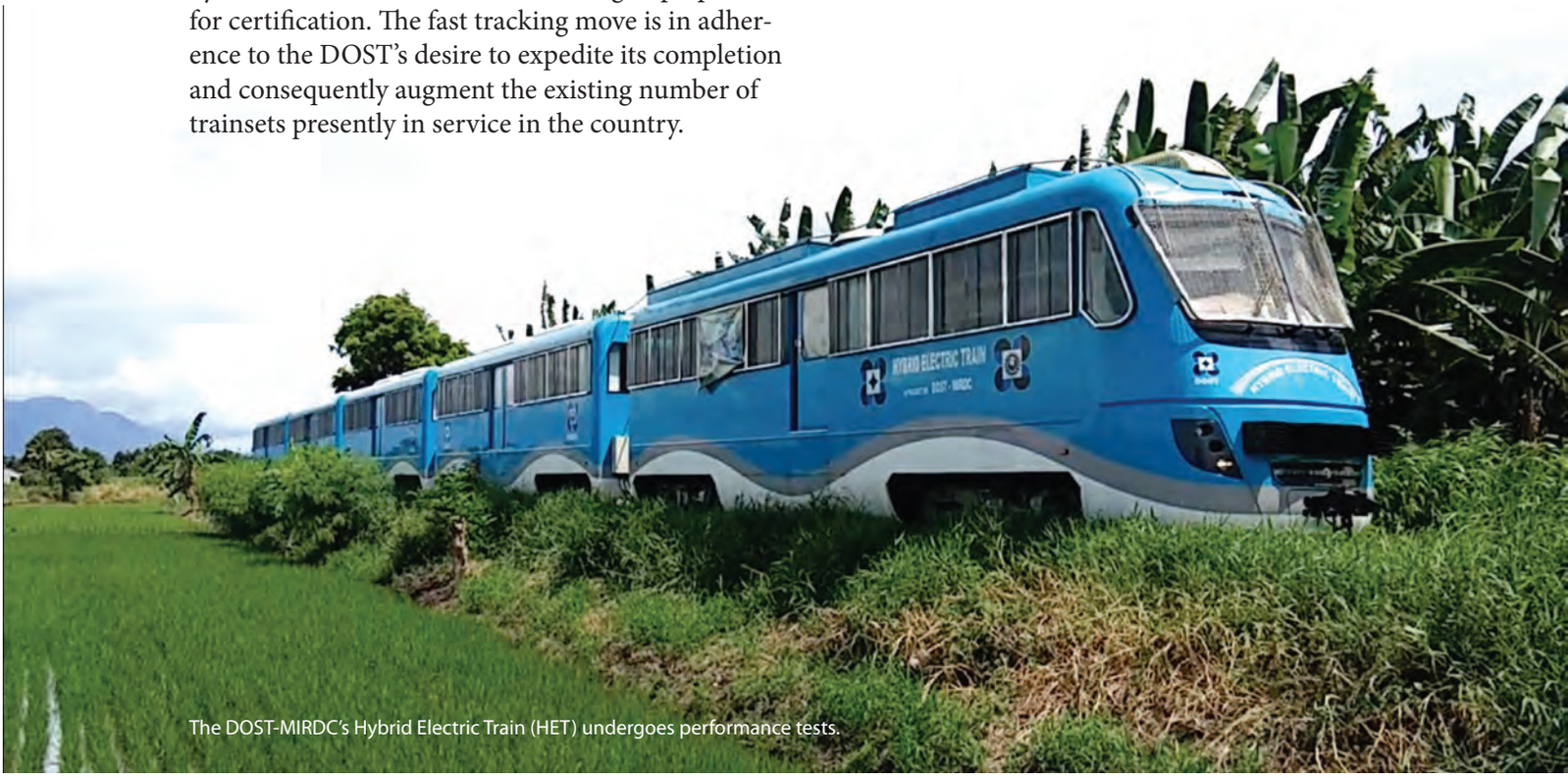
The DOST-MIRDC embarked on the performance testing and evaluation of the Hybrid Electric Train (HET) after its successful development in 2016. With the intention of validating its quality and safety, the entire train system was assessed based on the Functional and Performance Test Protocol drafted in keen coordination with the Philippine National Railways (PNR).

The HET testing was generally a success although there were issues and concerns along the way. Originally designed to run at a maximum speed of 80 kph, the train was limited to travel at a speed of only 40 kph because of the condition of PNR's rails. Testing track identification also significantly hampered the testing headway as the team had to relocate the train to a much safer and longer track. Finally, after the project team dutifully dealt with all the nitty-gritty, performance tests which cover Speed, Acceleration, and Braking Distance were fully performed under No Load, Design Load (175 passengers/coach), and Crush Load (220 passengers/coach) conditions.

Parallel with the testing activities, engineering firm Systra Philippines, Inc. (SPI) was contracted to conduct a gap analysis for the HET. The gap analysis aimed to determine the gaps between the design and per-

formance of the prototype trainset against the existing commercial units of the PNR. SPI confirmed the train's potential and required only minor upgrades before its certification and subsequently, its public use. Among the areas where mandatory checks and improvements were needed, according to the SPI report, were the floor and door, braking system, and shock absorption.

The HET is now primed to be in its new and finer form. Come early 2018, the optimization undertakings will immediately begin. This will be followed by the 5000 km-run endurance testing as preparation for certification. The fast tracking move is in adherence to the DOST's desire to expedite its completion and consequently augment the existing number of trainsets presently in service in the country.



The DOST-MIRDC's Hybrid Electric Train (HET) undergoes performance tests.


Functional testing of Sugarcane Cutter


Sugarcane Cutter

Design and Development of Sugarcane Harvesting Equipment for Small Farms

The DOST-MIRDC, in collaboration with the Sugarcane Regulatory Administration (SRA), developed the Sugarcane Harvesting Equipment (Cutter, Leaf-Stripper, and Loader) through the funding of the DOST-Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD) under the program 'Boosting the Sugarcane Industry through Smart Farming Processing Techniques.' This set of equipment aims to mechanize the sugarcane harvesting processes such as cutting, leaf-stripping, and truck loading, and address the declining labor force in the country's sugarcane industry. The equipment are compact, easy to operate, has a simple design, and can be transported easily in-between sugarcane farms. These prototypes were developed to increase farm efficiency, and reduce the cost of the said sugarcane harvesting processes, thus directly benefits the sugarcane industry. The patent for the machines has been filed and is subject for substantive examination by the Intellectual Property Office.

Design and Development of Sugarcane Cutter

Cutting is the initial stage of sugarcane harvesting. The developed sugarcane cutter aims to mechanize this process, and thereby increase efficiency through improved cutting rate. The equipment is easily operated through its built-in operation and control mechanisms. It is composed of the hydraulics, input conveying, cutting, and output conveying assemblies. Fabrication of the sugarcane cutter was completed in September 2016. The prototype underwent a series of functional testing for performance verification. Various parameters such as forward speed, working width, and theoretical capacity were gathered during its functional testing. The field testing was done in March and in September 2017 at the SRA–Luzon Agricultural Research and Extension Center (SRA-LAREC) in Paguiruan, Floridablanca, Pampanga to see the performance of the machine in an actual field condition.

Data gathered from the lab testing conducted at the DOST-MIRDC were analyzed. The project team gathered the following information: the average rotational speed of the cane cutter was 295.8 rpm and was deemed favorable; the average rotational speed of the collecting chains is 149.7 rpm on the left, and 150.3 on the right; and the conveying chains average rotational speed was computed to be 149.7 rpm on the left and 149.3 on the right.

The average productive time of the cutter gathered on the first field test was 13.5 mins, with an average operating speed of 0.22 m/s, and a width of cut of 1.2 m, consuming a total of 0.76 L/hr of fuel, with a total field capacity of 0.76 ha/hr. Data gathered from the second field test are as follows: the average productive time

Operation of Sugarcane Leaf-Stripper

Sugarcane Leaf-Stripper

of the cutter 14.92 mins; average operating speed of 0.22 m/s; a width of cut of 1.2 m; fuel consumption totaled 0.77 L/hr; and total field capacity of 0.76 ha/hr.

The equipment met the desired rotational speed of each component to properly function in the field. Actual field capacity on third gear low speed was identified to be the most suitable for field conditions. The equipment was scheduled for a series of field testing to further verify its functionality and performance parameters, analyze and evaluate data, and identify possible areas of design modification. Due to the losses observed by the team on the shifting of the sugarcane cutter from hill to hill, it is proposed that another cutter conveying to the left be fabricated to operate at the same time as the cutter conveying to the right to compensate the restriction of one sugarcane cutter.

Design and Development of Sugarcane Leaf-Stripper

After cutting, harvested sugarcane stalks are either used for replanting or milling. Those stalks for milling are usually leaf-stripped, but manual stripping does not completely free the stalks of unnecessary leaves. Manually leaf-stripped sugarcane stalks do not have a high market value, unlike those which are thoroughly cleaned and undamaged.

The sugarcane leaf-stripper aims to mechanize the cleaning and removal of unnecessary leaves on sugarcane stalks in preparation for their post-harvesting processes. The equipment has a simple design, compact, and has a built-in sugarcane-top cutter which cuts the leafy topmost part of the stalk. The machine can be operated by two (2) persons and can be transported easily from farm to farm with its built-in hitch connection which can be attached to a towing vehicle.

The leaf-stripping function of the machine is achieved by friction, provided by rotating brushes. The machine's input and output mechanism is composed of rollers. In addition, the distance between the de-trashing components and the rollers can be adjusted depending on the cane size and variety.

Field testing of the equipment was conducted in April and October 2016, and in January and March 2017 at the Central Azucarera Don Pedro (CADP), Nasugbu, Batangas and at the SRA-LAREC, Paguiruan, Floridablanca, Pampanga.

The data for the average capacity, fuel consumption, de-thrashing efficiency, and noise

Sugarcane Loader

Operation of Sugarcane Loader

level of the sugarcane stripper after the series of field testing were gathered and computed. The average capacity of the stripper gathered from the first field test was 2 tons cane/day, with a fuel consumption of 0.67 L/hr, a de-thrashing efficiency of 76.5%, and a noise level of 96 decibels. The average capacity of the stripper gathered on the second field test increased to 4.66 ton cane/day, with a fuel consumption lowering to 0.5 L/hr, a de-thrashing efficiency increasing to 77.2%, and a noise level of 96 decibels.

The average capacity, fuel consumption, de-thrashing efficiency, and noise level of the sugarcane stripper during series of field testing were gathered and computed. Based on the first field test, the average capacity of the stripper was 2 tons cane/day, with a fuel consumption of 0.67 L/hr, a de-thrashing efficiency of 76.5%, and a noise level of 96 decibels. For the second field test, the average capacity of the stripper increased to 4.66 ton cane/day, with a lower fuel consumption of 0.5 L/hr, a de-thrashing efficiency of 77.2%, and a noise level of 96 decibels. Further, the average capacity of the stripper gathered on the third field test increased to 5.99 ton cane/day, with a diminished fuel consumption of 0.51 L/hr, and an increased de-thrashing efficiency of 78.95%, and a noise level of 96 decibels. Furthermore, the average capacity of the stripper gathered on the fourth field test increased to 6.11 ton cane/day, with a lower fuel consumption of 0.53 L/hr, and a higher de-thrashing efficiency of 87.63%, and a noise level of 96 decibels.

The sugarcane leaf-stripper undergone design modifications prior to its second field testing at the SRA-LAREC sugarcane farms, improving its performance. The modifications were based from the drawbacks encountered in the initial field testing. Supplementary field tests will be performed to further improve and optimize the machine's performance.

After much brainstorming, the team concluded that adding a table in the design of the inlet hopper and shifting the whole system by 360 degrees would be more appropriate in terms of cane top disposal.

Design and Development of Sugarcane Loader

Sugarcane stalks intended for milling are thoroughly stripped off of their leaves, and are manually loaded into a transport vehicle and taken to the milling facility for postharvest processing. Manual loading of the harvested sugarcane stalks is a very tedious task for the farmers and a major factor that decreases loading efficiency. At the end of the day, losses are encountered due to manual loading. In the long run, these setbacks may affect the sugarcane industry of the Philippines.

The sugarcane loader addresses these difficulties by mechanizing the loading of sugarcane stalks into the transport vehicles. Inefficiencies

and delay caused by manual loading is eliminated, thus fast-tracking the postharvest processing of harvested sugarcane. The equipment can be easily transported since it can be attached to the transport vehicle's sides. It can be easily transferred from one farm to another because of its detachable wheels. It is easy to operate and requires minimal number of operators. The loading mechanism is by vertical reciprocation actuated by the weight of stalks trough the loading arm. The equipment can load a maximum weight of about 35 kgs per loading. The minimum weight of stalks loaded should be 5 kgs to automatically actuate the loading arm, otherwise the operator resorts to manual actuation by lightly pressing one of the loading arm.

Field testing of the equipment was conducted in April and October 2016 at the Central Azucarera Don Pedro (CADP), Nasugbu, Batangas and at the SRA-LAREC, Paguiruan, Floridablanca, Pampanga.

The average capacity, fuel consumption, and noise level of the sugarcane loader during the series of field testing were gathered and computed. Based on the field test, the average capacity of the loader was 41.44 ton cane/day, with a fuel consumption of 0.97 L/hr, and a noise level of 86.5 decibels. On the second field test, the resulting average capacity was 117.6 ton cane/day, with a fuel consumption of 1.46 L/hr, and a noise level of 86.5 decibels.

After modification, an evident increase in the capacity of the loader was observed. The team continuously aims to further modify and improve the performance parameters of the equipment. Series of field tests are scheduled to determine the equipment's areas of improvements. These, along with the inputs and suggestions of end-users, will be considered in further improving the functionality of the prototype.

After thorough study, the team proposed that a conveyor type sugarcane loader will be more efficient and better suited for the field work which will allow the operators to have minimal lag time loading the sugarcane in the loading truck.

12hp Single Cylinder Diesel Engine Prototype

Development of 12hp Single Cylinder Diesel Engine

Mechanization of farm operations is one of the technological challenges that the Philippines need to implement to attain agricultural modernization. Through modern farming technologies, farmers can expect lower operation costs, lesser post-harvest losses, better quality products, and increased profit. At present, local demands for single cylinder engines used in agricultural equipment are met thru importation. The Philippines is, clearly, completely dependent on other countries for the prime movers used in agriculture and in other sectors as well.

Field Testing of Prototype Coupled to a 5-ton capacity flatbed dryer

Field testing of prototype coupled to a 3"x3" water pump dryer

Field testing of prototype coupled to an agricultural trailer

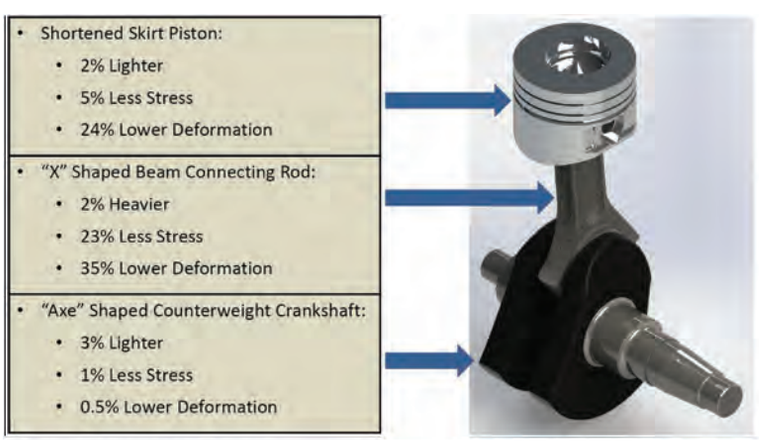
.Hand Tractor-Attached Transplanter

Table 1. Performance of the Prototype 12HP Single Cylinder Diesel Engine

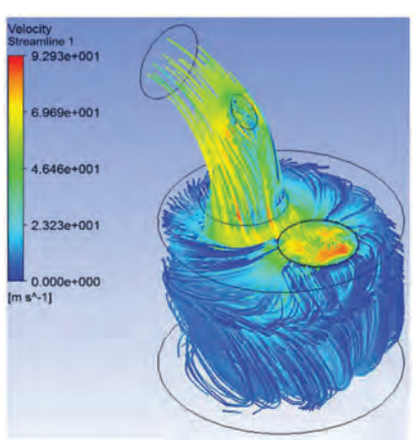
Performance Criteria	Standard	AMTEC Test (Average)
Maximum Power as Percentage of Rated Maximum Power, %	80	93.9
Continuous Power as Percentage of Rated Maximum Power, %	80	83.6
Maximum Noise Level (Continuous Running Test), dB(A)	92	90.6

The DOST-MIRDC, in cooperation with the Philippine Center for Postharvest Development and Mechanization (PHilMech) and the Supercast Foundry & Machinery Corporation (Supercast), developed the first locally fabricated single cylinder diesel engine under the project 'Development of 12HP Single Cylinder Diesel Engine.' The project aims to locally develop a single cylinder diesel engine that is 20% lower in terms of cost as compared to the leading brand. In addition, the project aims to establish a particular set of local manufacturers and suppliers of parts and components to sustain the local production of the engine once commercialization takes place.

Three prototypes were tested at the Agricultural Machinery Testing and Evaluation Center (AMTEC), UP Los Baños, Laguna. The test results showed that the prototypes achieved and exceeded the standard performance conditions.



Powertrain Components Improvement



CFD Model of Air Intake System

Hand Tractor-Attached Harvester

The prototype was coupled to different agricultural equipment during field testing at the PHilMech, Science City of Muñoz, Nueva Ecija. The prototype was coupled to a 5-ton capacity flatbed dryer, a 3"x3" water pump, and an agricultural trailer. The operators of the different agricultural equipment were very much satisfied with the performance of the prototype during the operation. The prototype is easy to start and handle. It ran smoothly at rated speed and was able to handle the load capacity of the different agricultural equipment.

Based on the results, the developed 12-hp single cylinder diesel engine was comparable to the leading commercial brand in the market and can be used as a prime mover of different agricultural equipment.

The project led to a joint collaboration with the University of Glasgow involving a 'Design Improvement of a Single Cylinder Engine through Finite Element Analysis' and 'Computational Fluid Dynamics Analysis of a Single Cylinder Diesel Engine.'

The project team recommends the conduct of further testing of the 12-hp single cylinder diesel engine with different agricultural applications in various regions of the country to assess the prototype's performance and durability. Likewise, the prototype should undergo industrial design to improve aesthetics and commercial feasibility. In addition, continued R&D initiatives are recommended to develop other capacities like 10-hp single cylinder diesel engine and gasoline engines as well.

Piloting of the Hand Tractor-attached Transplanter and Hand Tractor-attached Harvester in Selected Rice Growing Regions

TThe DOST-MIRDC, in partnership with the PHilMech, further assessed the functionality of the locally fabricated hand-tractor transplanter and harvester prototype attachments in various field conditions through the project entitled, 'Piloting of the Hand Tractor-Attached Transplanter and Hand Tractor-Attached Harvester' with funding from the DOST-PCAARRD. Completed in December 2017, these relatively new implements will aid rice production mechanization by making the transplanting and harvesting processes more efficient and effective.

The attachments can be readily mounted to and dismounted from a common hand tractor, thus increasing the utilization of hand tractors limited to land preparation activities. Moreover, the attachments are easy to operate and have low maintenance and repair cost.

With the assistance of local fabricators, the Center completed three (3) units each of the hand tractor-attached transplanter and the hand tractor-attached harvester. These prototypes were tested in the following selected rice-growing regions: Region II - Silap Irrigators Association in Brgy. Roxas, Solano, Nueva Vizcaya; Region III - AnakBukid Producer Cooperative (ABPC) in Brgy. Sto. Rosario, Sto. Domingo, Nueva Ecija; and Region IV-A - Puypuy Farmers Association in Brgy. Puypuy, Bay, Laguna.

The project team coordinates with potential technology adopters and beneficiaries.

The MIRDC features the locally designed and developed equipment during the 2017 National Science and Technology Week.

After a series of field testing and evaluation in varying field conditions, the test protocols and operation manuals were established. These will assist the prospective adopters/beneficiaries in utilizing the attachments efficiently. The MIRDC already filed the prototypes' Intellectual Property Protection at the IPOPhil in order to safeguard the intellectual rights of the developers. The prototypes were featured at the 2017 National Science and Technology Week (NSTW) to disseminate information to a wide-range of audiences, including potential adopters and future technology partners.

Rollout of DOST-Developed Food Processing Equipment to the Regions

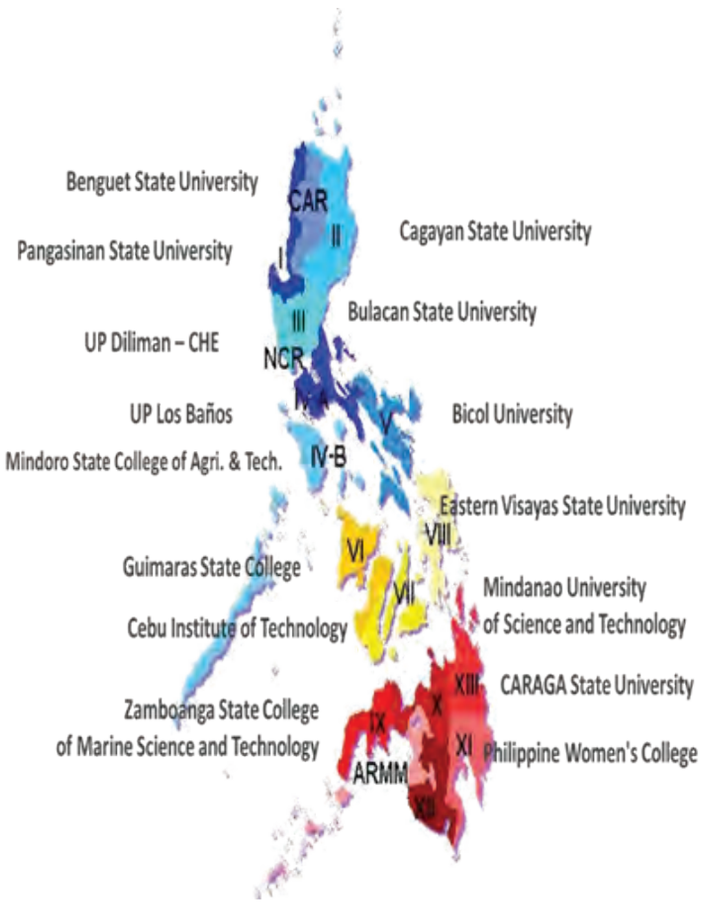
The project entitled, 'Rollout of DOST-Developed Food Processing Equipment to the Regions,' under the DOST's High Impact Technology Solutions (HITS) Program, successfully concluded in December 2017. This was implemented by the DOST-Industrial Technology Development Institute (DOST-ITDI) in collaboration with the DOST-MIRDC, DOST-Project Management and Engineering Design Services Office (DOST-PMEDSO) and all the DOST Regional Offices nationwide, with DOST-PCIEERD as the funding agency.

Through the project, the DOST aims to establish Food Innovation Centers (FICs) in the regions for the roll-out and promotion of locally developed food processing equipment; to demonstrate to food processors, academe, and other prospective users and adopters the efficient performance of the five locally-fabricated prototype equipment; and to conduct human resource training for potential equipment operators in the region.

The five food processing equipment, namely: Spray Dryer, Water Retort, Vacuum Fryer, Freeze Dryer and Vacuum Sealer have already been deployed to the established FICs located in all the eighteen (18) regions nationwide.

Food Processing Firms (FPFs) are recognized as prime movers of the country's economic growth. FPFs strongly supports economic development as experienced by most successful and newly industrialized countries in the world. However, technology-based food processors in the country are confronted with

DOST-developed food processing equipment deployed to the FICs.



Food Innovation Centers (FICs) nationwide

challenges with regard to access to information, capital, and high cost of equipment. The prohibitive cost of acquiring state-of-the-art equipment deprives local manufacturers the opportunity to expand their product lines in order to meet diverse range of customer requirements.

Strategically, FICs have been established in all the regions of the Philippines in partnership with selected state universities and colleges. Each FIC is intended to serve as a hub for food product development and innovation in the region, and is open for use of both public and private sectors. These FICs were established to assist food producers, processors, marketers, and entrepreneurs as they develop, improve, and promote their products.

Table 2 summarizes the deployed food processing equipment in the regions. Through the FICs, researchers from the academe and from the small and medium enterprises (SMEs) are provided easier access to food processing equipment.

During the initial stage of operation, the deployed equipment served at least 1,577 clients from the academe and industries nationwide. Furthermore, the regional FICs have developed at least 963 product prototypes out of 15,098

Table 2. Summary of Deployed Equipment

DOST 1	WR, VF, FD, VS
DOST 2	WR, VF, SD, FD, VS
DOST CAR	WR, VF, FD, VS
DOST 3	WR, VF, FD, VS
DOST 4A	WR, VF, FD, VS
DOST 4B	WR, VF, SD, FD, VS
DOST NCR	WR, VF, SD, FD, VS
DOST 5	WR, VF, FD, VS
DOST 6	WR, VF, SD, FD, VS
DOST 7	WR, VF, SD, FD, VS
DOST 8	WR, VF, SD, FD, VS
DOST 9	WR, VF, SD, FD, VS
DOST 10	WR, VF, SD,FD, VS
DOST 11	WR, VF, SD, FD, VS
DOST 12	WR, VF, FD,VS
DOST 13	WR, VF, FD, VS
ARMM	WR, VF, FD, VS (c/o ITDI)
FIC MAIN (ITDI)	WR, VF, FD, VS

Legend: ***WR – Water Retort; VF – Vacuum Fryer; SD – Spray Dryer; FD – Freeze Dryer; VS – Vacuum Sealer***

concepts. Some of these products are presented below.

The completion of the HITS project created opportunities for the regions to pursue further R&D such as product prototyping which showcases the innovativeness of the regions. The DOST continuously implements and develops new projects in support of the established FICs, some of which are the 'Development of Competence of the DOST FICs' and the 'Recognition of Most Innovative Products.'

During the FIC Summit held last 04 December 2017 at the Titanium Auditorium, DOST-MIRDC Compound, Taguig City, all the agencies and state universities involved in the project gathered together to present and share their accomplishments and best practices. Accordingly, a strategic planning workshop was also conducted that resulted to the formulation of the FIC Vision: The leading network of S&T innovation hubs bringing commercially viable food products in the global market and delivering world-class services to the Philippine food industry by 2022.

With all the positive feedback from the FICs and users of the food processing equipment, the DOST

Fig. 20. Products developed using the food processing equipment deployed at the FICs nationwide.



Inauguration of the Automated Complementary Baby Food Production Plant Facility



(L to R) Main control of the integrated equipment, packaging machine, twin screw extruder

is planning to proceed with equipment upscaling due to the demand for higher capacity and request to export the food processing equipment.

Automated Complementary Baby Food Production Facility

With the increasing awareness on the nutritional benefits of and demands for quality baby food products, the DOST-MIRDC, in cooperation with the DOST- National Capital Region (DOST-NCR), the DOST-Food and Nutrition Research Institute (DOST-FNRI), the Philippine Chamber of Commerce and Industry, the City Government of Valenzuela, and the Valenzuela City Polytechnic College, established an Automated Complementary Baby Food Production Facility that complies with regulatory standards for food manufacturing. The integrated processing facility includes critical baby food processing equipment, such as the pulverizer, mixer, twin screw extruder, 3-layer conveyor zed dryer, and packaging machine. Using Programmable Logic Controls (PLC) for sequencing and touch screen HMI (Human-Machine Interface) controls, the integrated equipment can be operated with less human intervention. During the functional and performance testing, the facility produced and packed rice-mongo curls and rice-mongo powder with 70% rice and 30% mongo formulation. Test results show that the facility can produce up to 120 kilograms of baby food blend per hour or about 4,000 sachets (30 grams per PET or foil sachets). According to the DOST-FNRI, the product (baby food blend) has a shelf life of one year when properly stored and protected. The DOST-FNRI recommends one (1) sachet per day serving to derive the full nutritional benefits for children 6-36 months old. Subsequently, the facility was inaugurated by the DOST officials and LGU representatives in September 2017.

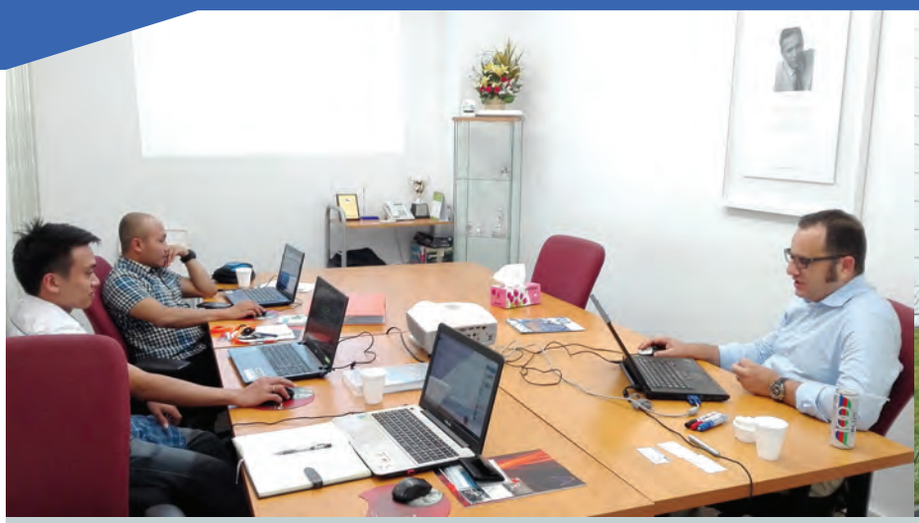
The use of the Automated Complementary Baby Food Production Facility can aid researches on baby food innovation and formulation, especially those which require special handling with minimal human interference. Likewise, the facility can be used for feeding program-related activities of the LGU and schools to promote the fight against malnutrition. In fact, the facility will be used by the City Government of Valenzuela as sustainability measure in their Barangay-Based Feeding Program (BBFP) with the support of the DOST-FNRI's 'instant rice-mongo blend technology' to replace the more expensive baby food product that is currently provided by the City to their residents. In addition, when it comes to technology advancement, it is said that the facility is the first, if not the only, automated baby food production plant in the country. As such, the facility serves as a model facility that can be replicated in other areas of the country. The Automated Complementary Baby Food Production Facility was established in Valenzuela City Polytechnic College with the principal office at Kamagong Street, Fortune Village IV, Parada, Valenzuela City, Metro Manila.

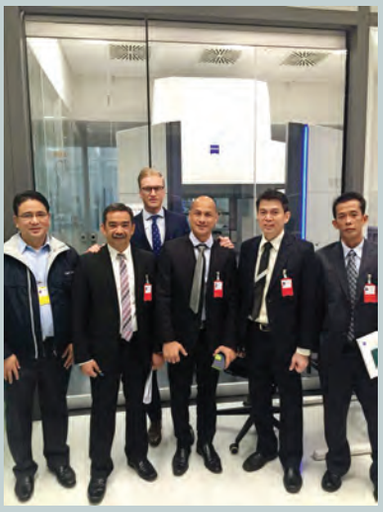
Establishment of a Gear Making and Assembly Facility

The project entitled, 'Establishment of a Gear Making and Assembly Facility' supports the Makinarya at Teknolohiya para sa Bayan (MakiBayan) initiative which aims to improve the competitiveness of the metalworking industry. This facility generally aims to enhance the local capabilities for gear design and production, and develop gear assembly manufacturing industry for transport, metalworking, and agro-industrial applications. At present, very few companies are into the design and manufacture of gears in the Philippines. The lack of gear manufacturing facilities may be attributed to the insufficient production equipment and lack of experienced and knowledgeable personnel. Through this project the DOST-MIRDC aims to promote the development of the design and manufacture of gears, and to offer gear making technologies and facilities to manufacturing industries.

The completion of the Gear Making Facility will be a big boost in enhancing the competitiveness of the local gear making industry particularly in localizing gears which are currently imported. From 2015 to 2017, nine (9) major equipment were acquired, including Gear Measuring Equipment, Dynamic Balancer (CIMAT-1500 H2P), CNC 5-axis Vertical Machining Center (Okuma MU-6300V), CNC Gear Hobbing Machine (GE25A), Vacuum Carburizing Machine, CNC Gear Shaping Machine (ST25CNC), and CNC Gear Shaving Machine (FE30A). Also, Deburring and Broaching Machines will complement the facility. In addition to these state-of-the-art machines, a Gear Software (KISSsoft and KISSsys) was also acquired. The KISSsoft is a design software used to perform accurate size calculations for machine elements, while the KISSsys depicts a complete

Newly acquired equipment (from left): Gear Measuring Equipment, Dynamic Balancer CIMAT-1500 H2P, CNC 5-axis Vertical Machining Center Okuma MU-6300V, CNC Gear Hobbing Machine GE25A, CNC Gear Shaping Machine ST25CNC, Vacuum Carburizing Machine and CNC Gear Shaving Machine FE30A





Photos taken during the factory acceptance and training abroad

system of machine elements and is used for strength calculation of each element. Access to these advanced dedicated technology and facilities on gear making are provided to SMEs through a shared-service-facility scheme at reasonable rates.

As component of the Gear Making and Assembly Facility project, several DOST-MIRDC engineers and technicians attended local, as well as international training programs, to learn new techniques and good manufacturing practices in countries like Germany, India, Korea, Poland, Singapore, Switzerland and Thailand. Additional training programs in Japan will be attended by MIRDC personnel in the first quarter of 2018.

Human resource capability upgrading was also implemented for the industry with the pilot implementation of a two-month training course on Gear Making and Basic Gear Design. Twenty (20) participant-trainees graduated from the said training program that included lectures, and actual designing and fabrication of gears as industry projects. As part of the training program, a plant tour was conducted at the MOOG Controls Corp. in Baguio City which was participated in by both DOST-MIRDC personnel and participant-trainees. Witnessing and observing the actual gear making industry definitely intensified their aspirations to work in the said industry. The MOOG engineers also provided lectures covering various topics on Gear Manufacturing, The Metallurgy of Gear Making, and Gear Manufacturing – The MOOG Model.

Among the outputs of the project are the gears used by various internal projects such as: (1) Development of Gear System for 12HP Single Cylinder Diesel Engine; (2) Development of Gear System for Rice Transplanter Front Transmission; (3) Development of Gear System for Speed Reducer with Gear Ratio 1:30; and (4) Development of Gear System for Speed Reducer with Gear Ratio 1:100, which were manufactured using equipment and technologies housed in the Gear Making Facility.

With the newly established Gear Making Facility, the DOST-MIRDC can now provide assistance to the M&E industries under a facility sharing scheme and consultancy services involving gear design using recently acquired software.

Fig. 25. Gear Making and Basic Gear Design Trainees in action.

Gear Making and Basic Gear Design Graduates: October 18 – December 15, 2017

The HERT at Freedom Park, Gen. Santos City during the grand launching last December 16, 2017

(Left) Proposed commercial model of the Hybrid Electric Road Train with a rounder face of the Pilot Coach. (Right) The new configuration of the motors in the commercial model of the HERT. Instead of the previous vertical configuration, the motor will be horizontally placed under the chassis to accommodate more passengers inside the coaches

Highlights of Other Project Initiatives

Testing for Standardization and Optimization of Five-coach Hybrid Road Train Phase III

This project, which started in 2017, aims to produce a design drawing of the Hybrid Electric Road Train (HERT) commercial model. The design drawing will be transferred to interested fabricators and adaptors subject to a license fee.

The same project also funded the transfer of the regular version of the HERT from Cebu City to General Santos City after the techno-promotional activities in Cebu. The city council of General Santos City, through the efforts of incumbent City Councilor Atty. Dominador Lagare Jr., requested for the HERT to be used

Officials of DOST and General Santos City attended the MOU signing regarding the use of Road Train in Gensan

Road Train project staff check and test the newly arrived lithium titanium oxide (LTO) batteries that will be installed in the Light Hybrid Electric Road Train

in General Santos as an alternative transport system for their commuters.

A grand launching of the HERT in Gensan was held on December 16, 2017, with DOST Secretary Hon. Fortunato T. Dela Peña, City Mayor Hon. Ronnel Rivera, and MIRDC Executive Director Engr. Robert O. Dizon as the most distinguished personalities. During the event, a memorandum of understanding between MIRDC and the Gensan City Government was signed to signify the start of a great partnership to serve the public.

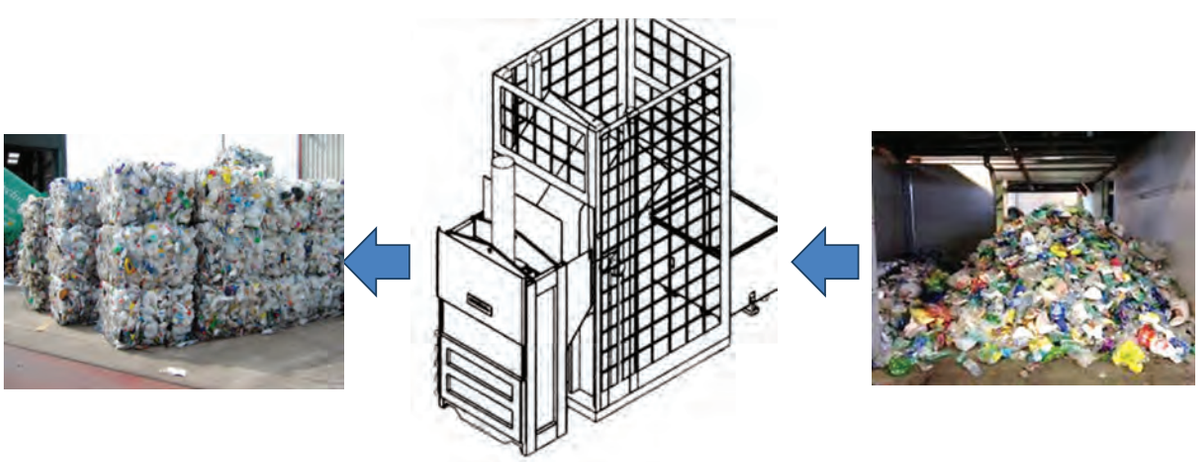
Modification of Road Train Energy Storage System Using Lithium Titanium Oxide Batteries

The project aims to replace the old and heavy lead acid batteries of the HERT with newer and lighter lithium titanate batteries. By replacing the lead acid batteries with lithium batteries, the maintenance will be easier, the power coach will be lighter, and the life cycle of the batteries will be longer.

Design and Development of Equipment for Biomass Waste Management System

The DOST-MIRDC, in partnership with LIMETECH, fabricated a baler equipment under the project 'Design and Development of Equipment for Biomass Waste Management System' to address the growing problem of solid waste management in the country.

As the world population grows, so does solid waste generation. Solid wastes remain poorly managed and thus, pose a pressing challenge to the society. According to the Department of Environment and Natural Resources' (DENR) National Solid Waste Management Status Report from 2008 to 2014, the yearly amount of waste in the country is expected to increase from 13.48 million tons in 2010 to



Baler process from solid waste to bale using the baler machine

Technical Specifications:

Pressure (psi)	Max = 3,000; Working = 2,200
Power Supply	220V AC, 3-phase
Motor (Hp)	10
Cycle Time (seconds)	120
Maximum Capacity (tons)	3
Chamber Inlet (W x H)	1500 mm x 500 mm
Chamber Height (mm)	1500
Baler Stroke (mm)	1100
Tippler Stroke (mm)	671
Bale Volume (W x D x H)	1500 mm x 750 mm x 1000 mm
Fittings	SS

14.66 million tons in 2014 to 16.63 million tons in 2020. Effective waste management is needed by the industrial sector. Companies like Japan Tobacco International (JTI) have plants that generate around 3 tons of waste per day. A demand for waste management sustainability is called out by companies like JTI. Waste management technology aiding the solid waste management of such companies that is economically affordable, industrially reliable, socially accepted, and enviromentally friendly needs to be availbe in the market as soon as possible. In order to address this, there is a need to develop a biomass waste management system such as the baler, which is an easy, cost-effective solution to dispose trash safely.

The baler is a high pressured equipment used to compress solid materials, usually dry materials for ease of transport and management. Common balers are usually rectangular or cylindrical in shape, and used to bail hay, straw, grass, and other dry materials. Industrial balers are most commonly used in material recycling facilities for bailing metals, plastic, or paper for compact storage or transport.

The DOST-MIRDC baler designed much like the industrial baler. It compacts collected solid waste by means of high pressure, then releases rectangular bales for easy, efficient, and safe disposal. It is composed of three major parts: the Bin, where the solid waste is filled in; the Baler, that compacts the trash and releases them as bales; and the Tipler, that conveys the bin to the inlet of the baler chamber.

Development of a Commercial Prototype Automated Guide-way Transit System in UP Diliman

This project was proposed with the aim to complete the system design of the AGT in preparation for its certification and commercialization. Prior to its approval in July 2017, the DOST-MIRDC has been conducting series of activities to promote the AGT and to seek advice from transportation experts.

Project team with Dr. Han of KIMM. Shown at the back is the Maglev developed by KIMM.

Project Team tours LRT-1 maintenance depot.

Photo of project team at Incheon International Airport. The airport serves as the end station for the Urban Maglev or "Ecobee".

In light of the DOST's direction to transfer the technology to an adopter, the DOST-MIRDC conducted several strategic activities. On April 4, 2017, the MIRDC held a round table discussion with transportation experts to discuss the necessary steps toward certification and commercialization of the AGT. The consensus is that the country needs more feeder mass transport system to complement the existing ones. This was how the AGT is seen as a promising alternative technology solution. However, experts believed that the AGT still lacks critical components to make it a safe and viable mode of mass transportation. One way to fast track the development was to partner with a private investor. For this reason, the MIRDC published a "Call for Proposal" inviting investors to be R&D partners in furthering the development of the Automated Guide-way Transit (AGT) until commercialized. The Redis Global Corporation (RGC) responded by submitting a letter of interest.

The project team, through the "Public-Private Partnership for the People Initiative for Local Government (LGU P4)" program of the Department of Interior and Local Government (DILG), presented to various local government units in Luzon and Visayas the AGT and other mass transportation projects of DOST. The program aims to build a stronger partnership between LGUs and the private sector in implementing infrastructure projects and basic services. The Iloilo City expressed interest in adopting the AGT connecting their airport to the city.

To have a more detailed idea on track switches, signaling, emergency protocols, etc., the project team studied these components in several train systems in South Korea with the help of the Korea Institute of Machinery and Materials (KIMM) on October 23-28, 2017.

The project team also conducted ocular visits in LRT-1, LRT-2 and MRT-3 depots to observe and come up with detailed design of various components of the maintenance depot. The team designers had a complete tour of the facility and took note of the specifications, dimensions and other vital data and figures.

It is expected that at the end of this project, the commercial design of AGT system has been completed and is ready for commercial adoption.

System Expansion of 120-Passenger per Coach Capacity Automated Guide-way Transit System

After the successful development of the 120-passenger AGT prototype in Bicutan, it underwent thorough functional, performance and endurance testing to verify the technical soundness and readiness of the technology. It was tested for approximately 6,000 kilometers already under various conditions and loads. Rolling stock experts from France also evaluated the AGT to assess its compliance to international standards particularly to the Automated People Mover Standards by the American Society of Civil Engineers (ASCE). Based on the tests con-

Project team pose at the AGT Bicutan site.

ducted and comments from the experts, a proposal was made to apply modifications and improve the AGT rolling stock.

This project was approved in July 2017 and will end in April 2018. Prior to approval, a series of activities were conducted in line with possible technology transfer of the AGT. In May 2017, a "Call for Proposal" was published by the DOST-MIRDC to invite interested investors to be the Center's research and development partners in furthering the development of the AGT until certified and commercialized. The Redis Global Corporation (RGC) responded by submitting a letter of interest. While the investor will provide initially the one-kilometer route and shoulder expenses of the construction of track to test the AGT at higher speed, the MIRDC on its part will provide the improved version of the AGT rolling stock. The objective of this partnership is for the AGT to eventually be used by the riding public. For this reason, the AGT Bicutan rolling stock was proposed to be improved and be readied for possible commercialization.

Improvement of Rolling Stock

The project team scouted for an upgraded specification of differential axle that will fit into existing prototype to address issues concerning brakes, suspension, traction speed and torque. The team inquired from different truck suppli-

Project team studies the park brake system of a truck on display.

Photos during unmounting of AGT.

Photos during transfer of AGT coaches from MIRDC to Fil-Asia in Pasig City.

ers/dealers and bus body builder such as Mitsubishi, Isuzu, Tata motors, Hyundai and Fil-Asia.

The scope of work for the improvement of the rolling stock includes modifications on the braking system, suspension system, sliding door mechanism, fire proofing and other auxiliaries. It is estimated that by April 2018, the improvement works will be completed.

Unmounting of AGT rolling stock

Parallel activity to the scouting for differential axles and finalizing the terms of reference, the team also fabricated lifter assembly, spreader and catch mesh wire in preparation for the unmounting of the AGT rolling stock to introduce needed modifications.

On November 30, 2017, the project team successfully unmounted the two (2) AGT coaches using a 100-tonner overhead crane. It took approximately 5-6 hours to complete the activity.

On December 17, 2017, the two (2) coaches were transferred to Fil-Asia in Pasig City. Modifications/improvements are currently being done.

Promotion and Demonstration

On December 1, 2017, the project team met with Valenzuela City Mayor Rex Gatchalian regarding the LGU's interest in adopting the AGT along MacArthur Highway from Marulas to Malanday with an approximate distance of 6.7 kilometers. He requested if the AGT's partner investor, Mr. Tony Tan of Redis Global Corp., can shoulder the expenses for a feasibility study of the technology along the abovementioned route. Mr. Tan is still studying the request and plans to submit an unsolicited proposal to Valenzuela LGU.

Through Mr. Francis Yuseco, Councilor Gene Puzon expressed their interest in the AGT for Sucat Road in Parañaque City. The project team intends to meet with them soon while AGT is being readied for a demonstration ride.

With the improvement of the AGT Bicutan prototype and the expressed interest of the investors and local government units, it is hoped that the first AGT will soon be seen in the country.

Examples of Through Hardening Gear Steels (AISI)	
Carbon Steels	1035, 1040, 1045, 1050
Free Cutting (resulfurized) carbon steels	1137, 1141, 1144
Alloy Steels	1340, 3140, 4140, 4340, 5140 6145, 8640
Examples of Carburizing Gear Steels (AISI)	
Carbon Steels	1010, 1015, 1020, 1025, 1524, 1527
Resulfurized Steels	1117, 1118
Alloy Steels	3310, 4023, 4118, 4320, 5120, 8620, 9310
Special Alloys	CBS-600, CBS-1000M

Vacuum Carburizing Heat Treatment Furnace

Metals, particularly steels, have numerous applications in various industries: construction, machineries, automotive, aerospace, to name a few. Their diverse use is attributed to their wide range of mechanical and other properties brought about by their composition, phases and microstructures as well as other characteristics. The performance of metals is dictated by the properties they possess, which in turn are influenced by conditions of their microstructure. Modifying the microstructure will result to altered properties which translate to new qualities with different performance. Subjecting metals to cycles of controlled heating and cooling, also known as heat treatment, is one way to alter the microstructure. By following specific heating and cooling procedures, the desired properties are achieved and performance is enhanced.

Heat treatment is carried out more commonly through the use of atmosphere or conventional furnaces. However, due to the nature and design of such furnaces, heat treated samples are susceptible to surface quality degradation, like oxidation, decarburization, and other adverse chemical reactions. In order to prevent such phenomena from occurring, the environment inside the furnace chamber must be practically devoid of reactive matter. To ensure such condition is achieved, vacuum condition must be established. Thus, vacuum heat treatment is the technology which addresses maintaining of surface quality of metals during heat treatment process.

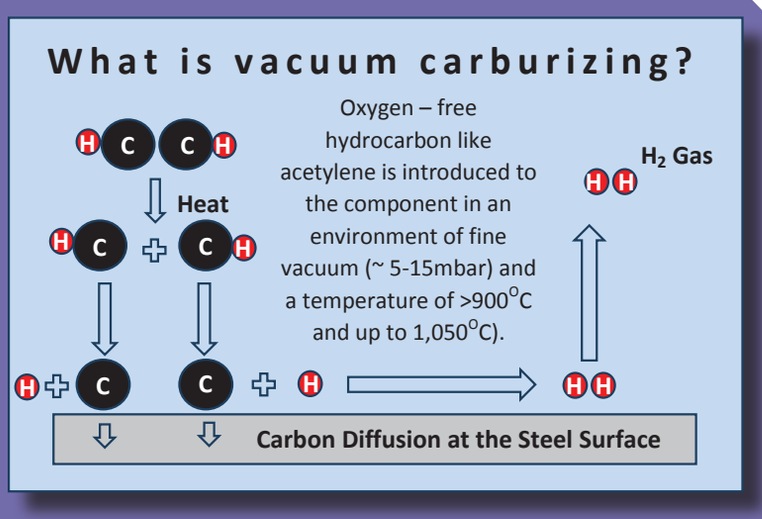
The DOST-MIRDC has both conventional and vacuum furnaces housed at its Surface Engineering Facility. In addition, the Center acquired a Vacuum Carburizing Heat Treatment Furnace through the Establishment of a Gear Making and Assembly Facility project under the Prototyping Division (PD). The project aims to enhance local capabilities for gear design and prototype production and develop gear assembly manufacturing industry for transport, metalworking and agro-industrial applications. Specifically, the project aims to establish gear design and prototype production facility and provide facility sharing services. The newly installed furnace will address the heat treatment and carburizing requirement of gears designed and manufactured by PD.

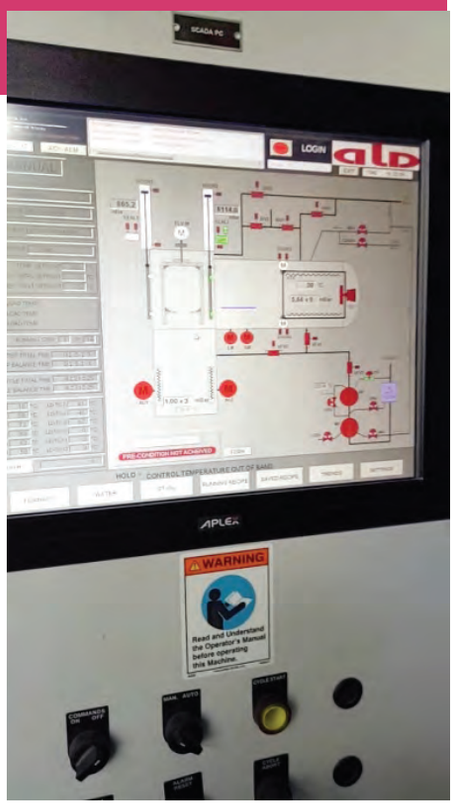
Gears can be hardened generally in two ways: through hardening and case hardening. Most steels used for through hardening have medium carbon content and presence of low alloy content. Alloys are added to increase hardenability. Case hardening on the other hand is selective hardening, where a thin portion of the surface is hardened and the rest of the bulk remains relatively soft and tough. Typical materials used are low carbon steels, either with or without alloying elements.

There are several case- hardening methods available in industries today. Primarily, these include but not limited to carburizing, nitriding and carbonitriding. Carburizing is the most common method, where steels are subjected to elevated temperature in an environment of sufficient carbon availability and potential to cause adsorption at the surface followed by diffusion producing carbon concentration gradient from the surface to the core. Carbon can be introduced by gas (atmospheric- gas, plasma, and vacuum carburizing), liquids (salt bath carburizing), or solid compounds (pack carburizing). The most common method used for large scale production is by gas, primarily because it can be accurately controlled.

The ALD DTO 60 75 100 Furnace Model has the following general specifications:

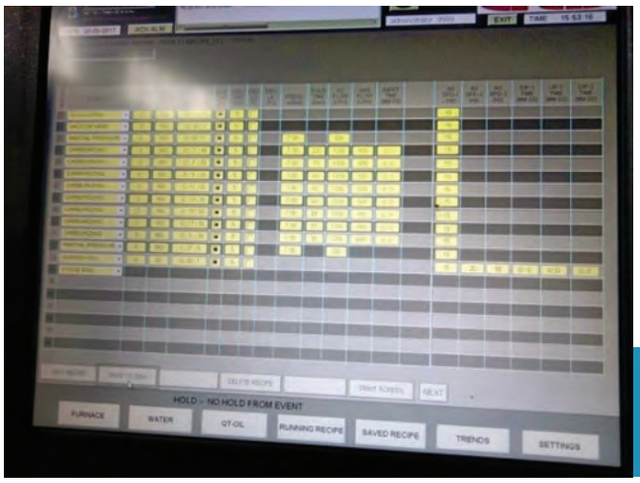
SPECIFICATIONS	ALD DTO 60 75 100 Furnace
Soaking Zone (L x W x H)	1000mm x 600mm x 750mm
Heating Element	Graphite rods (120kW)
Maximum Heating Temperature	1080^{O}C
Maximum Working Temperature	1050^{O}C
Loading Capacity	500 kg (max); batch type, horizontal; provided with 1 ton hydraulic/ electric lifter
Oil Quenching System	10,000 liter capacity pit type having two (2) agitators with speed control; vertical immersion oil heater from 30 to 150^{O}C as oil temperature control
Software for heat treatment cycles	Operational program navigated through touch panel; simulation software (VC-SIM) included
Carburizing Gas	Acetylene with regulation and control system
Data Management	MS Office based database management
Leak Detection System	Inclusive of gauges and other detectors to sense leak during operation fault





Control panel of the carburizing furnace showing the status of system.

The newly installed Vacuum Carburizing Heat Treatment Facility installed at the MIRDC Surface Engineering Bldg.



Control panel showing the sequence of carburizing steps and the corresponding measured parameters in the equipment and utilities.

Vacuum Carburizing:

Advantages		Disadvantages
1) High mass production 2) Short process time 3) Process easy to control 4) High reproducibility 5) Proven technology 6) High flexibility 7) Automation possible 8) No surface oxidation 9) No intergranular oxidation 10) No contamination or flames	VS	1) High maintenance requirements of the equipment 2) High consumable demands 3) Vacuum pumps

References

AMG ALD Process of Vacuum Carburizing, May 2017.
Davis, Joseph R., ed. Gear materials, properties, and manufacture. ASM International, 2005.

MFO 2 – TECHNICAL ADVISORY SERVICES

R&D runs in our veins. But the Center also makes sure that it delivers technical services that provide needed for interventions that truly matter to the industries we are mandated to serve. Our vision to become the center of excellence in science, technology, and innovation for globally competitive metals, engineering, and allied industries by 2025 is not just a statement. It is a commitment.

2017 was a productive year for the Center. Individual efforts of various groups involved in the delivery of technical services – training of engineers and technicians, information exchange, quality control and testing, technology transfer, and business economics advisory - added up to make all these accomplishments possible.

A. Seminars and Training of Engineers and Technicians

The Industrial Training Section (ITS) has been actively supporting the mandate of the DOST-MIRDC in catering to the training needs of the workforce of the metals, engineering, and allied industries, and other clients through enhancing their knowledge and skills in diverse fields.

A total of 163 training programs were conducted from January to December 2017 with 4,441 participants from 637 firms, which generated revenues amounting to Php3.55 million. Tables 3-5 present the list of training programs, frequency, and the number of persons trained for regular, packaged, and regional training programs.

Table 3. Regular Training Programs Conducted

Training Program	Frequency	No. of Trainee
CNC Milling Programming and Operation	2	15
Developing and Implementing A Laboratory Quality Management System Based on ISO/IEC 17025	1	16
Dimensional Metrology 1: Basic Measurement	5	102
Dimensional Metrology 2: Basic Length Calibration	4	52
Dimensional Metrology 3: Limits and Fits and Inspection of Geometrical Tolerances	2	14
Establishment of Preventive Maintenance System	1	11
Industrial Calibration	2	48
Nondestructive Testing	2	15
Plastic Injection Molding Machine Programming and Operation	1	8
Product Costing	1	6
Production Planning and Control	1	8
Root Cause Analysis	1	9
Shielded Metal Arc Welding	1	6
Tungsten Inert Gas Welding on Carbon Steel Plates	2	7
Uncertainty of Measurement	2	16
TOTAL	**28**	**333**

Table 4. Packaged Training Programs Conducted

Training Program	Frequency	No. of Trainee
Awareness on Risk Management	13	405
Awareness Seminar on ISO 9001:2015	13	441
Awareness Seminar on ISO/IEC 17025:2005	2	62
Brazing Processes (Copper & Other Metals)	1	15
Calibration of Temperature Controlled Enclosures & Universal Testing Machine	1	11
Dimensional Metrology: Calibration & Uncertainty of Measurement	1	5
Dimensional Metrology: Measurement and Calibration	1	6
Electroplating Processes	1	6
Engineering Drawing by NX Basic Design & Mastercam System	1	15
Heat Treatment of Steels	1	16
Internal Quality Audit	11	254
ISO/IEC 17025 Internal Quality Audit	2	31
Liquid Penetrant Testing	1	10
Machine Shop Operations	1	8
Mechanical Testing	1	20
Metal Fabrication	1	8
Nondestructive Testing	1	8
Production Planning and Control	1	33
Project Management	1	35
Root Cause Analysis	3	79
Shielded Metal Arc Welding	2	18
Technical Capability Enhancement for Local Agricultural Machinery Manufacturers	1	27
The Basics of Die Design and Fabrication and the Fundamentals of Pressworking	1	5
Transition to ISO 9001:2015 Workshop	11	345
TOTAL	**73**	**1863**

Table 5. Regional Training Programs Conducted

Training Program	Frequency	No. of Trainee
Awareness on Risk Management	3	50
Awareness Seminar on ISO 9001:2015	4	98
Electroplating Processes	1	6
Fundamentals of Welding Technology	1	13
General Welding Processes & Machine Shop Operations	2	42
Gas Metal Arc Welding / Metal Inert Gas - Metal Active Gas Welding	1	38
Heat Treatment of Steels	3	74
Information Seminar on Asian Welding Federation-Common Welder's Certification Scheme	1	84
Information Seminar on Electroplating/Metal Polishing	1	17
Information Seminar on General Welding Processes	1	48
Information Seminar on Heat Treatment of Steels	1	28
Information Seminar on ISO 9001:2015	1	18
Information Seminar on Occupational Health & Safety	1	18
Information Seminar on Preventive Maintenance System	1	37
Information Seminar on Principle, Operation & Application of Arc Welding/Basic Welding	1	208
Information Seminar on Productivity Improvement Through 5S Practice	3	79
Information Seminar on Welding Defects & Safety on Oxyacetylene Welding	1	157
Information Seminar on Welding Processes	1	17
Information Seminar on Welding Safety Practices in Dealing with Oxygen Acetylene Cylinders	1	79
Information Seminar on Wrought Iron Forming	1	16

Table 5. Con't.

Training Program	Frequency	No. of Trainee
Internal Quality Audit	3	59
Machine Shop Operations	2	47
Metal Fabrication Through Wrought Iron Forming	2	43
Metal Finishing Techniques	1	24
Milling Machine Operations	1	31
Occupational Safety	4	129
Occupational Safety Hazard	1	27
Overview of Occupational Health & Safety	1	25
Oxyacetylene Welding	1	29
Preventive Maintenance	1	19
Product Costing with Simple Bookkeeping	1	33
Production Planning and Control	2	42
Productivity Improvement Through 5S Practice	4	151
Project Management	1	29
Safety & Technical Aspects in Handling Oxygen Acetylene Set-up Used in Welding & Allied Processes	1	147
Transition to ISO 9001:2015 Workshop	1	34
Tungsten Inert Gas Welding on Carbon Steel Plates	1	24
Welding Inspection & Testing	1	104
Welding Metallurgy	1	87
Welding Processes (Tungsten Inert Gas Welding /Metal Inert Gas /Shielded Metal Arc Welding)	1	23
Wrought Iron Forming	1	6
TOTAL	**62**	**2240**

Table 6. Distribution of Training Programs Conducted, by Region

Training program	Number of programs conducted per region																
	NCR	CAR	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	CAR AGA	ARM M	TOTAL
Metalworking Technology	18		6			9		4	2						5		44
Analysis & Testing	22					1											23
Engineering, Production & Planning	5	1			1	2	2										11
Management/ Productivity Improvement	1		2			2			1	1							7
Others	31	5	5	3	3	13	3		3	2		4	5		1		78
TOTAL	**77**	**6**	**13**	**3**	**4**	**27**	**5**	**4**	**6**	**3**	**0**	**4**	**5**	**0**	**6**	**0**	**163**

Support in the establishment and sustainability of the implementation of Quality Management Systems of the DOST family

The DOST-MIRDC continuously supports the establishment and sustainability of the implementation of Quality Management Systems (QMS) of the DOST family. In 2017, a total of 53 out of 78 seminars were conducted in the DOST Central Office, DOST-Science and Technology Information Institute (DOST-STII), Philippine Science High School System-Davao Campus, DOST Regional Offices (DOST 1, 2, 3, 5, 7, 8, 10, 11, NCR, CAR, CARAGA, MIMAROPA), DOST-National Research Council of the Philippines (DOST-NRCP), DOST-National Academy of Science and Technology (DOST-NAST), DOST-Food and Nutrition Research Institute (DOST-FNRI), DOST-Forest Products Research and Development Institute (DOST-FPRDI), and DOST-Philippine Nuclear Research Institute (DOST-PNRI). Dr. Danilo N. Pilar provided needed inputs to assist the DOST agencies in their transition/ certification to ISO 9001:2015.

The programs conducted include Root Cause Analysis, Internal Quality Audit, Transition to ISO 9001:2015 Workshop, Awareness on Risk Management, and Awareness Seminar on ISO 9001:2015.

PTRI. Awareness on Risk Management. March 9, 2017.

PNRI. Awareness Seminar on ISO 9001:2015. March 13, 2016.

DOST 2. Awareness Seminar on ISO 9001:2015. Transition to ISO 9001:2015 Workshop, Awareness on Risk Management. March 21-23, 2018.

DOST CAR. Awareness Seminar on ISO 9001:2015. Transition to ISO 9001:2015 Workshop, Awareness on Risk Management. March 27-29, 2018.

Impact assessment

The ITS conducted an impact assessment survey to evaluate the benefits and impact of the training programs (regular, packaged and regional) to the participants and the organization. This activity is administered six months after the conduct of training. A total of 680 questionnaires were released with 526 accomplished questionnaires retrieved.

Figure 1 shows the distribution of impact assessment from the training programs attended for the period January to December 2017.

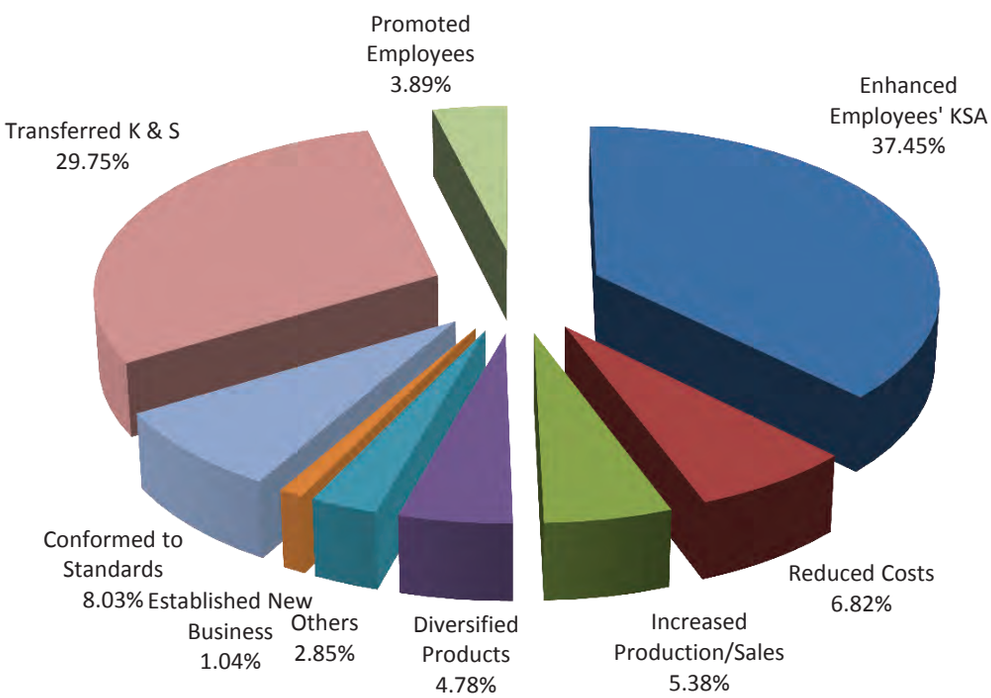


Figure 1. Distribution of Impact Assessment for the period January to December 2017

B. Information Exchange

The many years of proactive performance have creatively molded the DOST-MIRDC to become what it is today – dynamic and dependable. In 2017, the Center's dynamism and dependability rendered it able to rise above pressing challenges to deliver the necessary services and arrive at targeted outputs. Behind all of the Center's success is a truly proactive Technology Information and Promotions Section (TIPS) that handles effective and far-reaching information dissemination and promotions of the Center's R&D outputs and services.

Committed to be involved in the realization of the DOST-MIRDC's vision, the TIPS has always made its services available to various divisions of the Center. There is no better way to say it: The TIPS is where the action is.

Production and dissemination of Information, Education, and Communication (IEC) materials

The DOST-MIRDC engaged heavily in the implementation of its R&D projects and S&T services in 2017, hence, the requirement for the timely production of IEC materials and the conduct of technology promotion-related activities. With the TIPS' reliable support, the Center is assured of the availability of such materials when and where they are needed.

The DOST-MIRDC 2016 Annual Report was released in March in compliance with the directive of the DOST that Annual Reports of all its attached agencies be available for circulation 45 days after the start of the year. The Philippine Metals and the Metals and Engineering (M&E) Week 2017 Souvenir Program were released in the month of June, both in time for the celebration of the M&E Week and the Founding Anniversary of the Center.

Aside from these major publications, the TIPS was also behind the production, printing, and distribution of technology brochures which were disseminated to exhibition guests, plant visit participants, and local and foreign visitors from the industry, the academe, and government organizations. In 2017, the TIPS was also able to hit its target of releasing the September-December 2016, the January-April 2017, and the May-August 2017 issues of the Trends and Events. The Trends and Events is the Center's newsletter that features MIRDC updates, random news about M&E, new products and processes, industry and R&D news, and success stories of firms which received interventions from the DOST-MIRDC.

Valuing the impact of artistic and communicative media, the TIPS spearheaded the production of video materials also designed for promotion and information dissemination. Through TIPS' assistance, the Center came up with videos on technologies and facilities such as the Die and Mold Solution Center (DMSC), the Gear Making and Assembly Facility, and the Surface Engineering facility, among others. These were presented during exhibits, orientation of plant tour guests, and visits of DOST-MIRDC staff to the regions.

Handling of the Center's press releases and media engagements

News about the Center's R&D output and S&T services were picked up by the media and featured in various media platforms. Among the projects and activities of the DOST-MIRDC that drew the media's attention were the Mass Transportation projects: the Automated Guideway Transit (AGT) System; the Hybrid Electric Road Train (HERT); and the Hybrid Electric Train (HET). Also gaining media exposure were the Superheated Steam Treatment System (SSTS) that prolongs the shelf life of brown rice, plans and upcoming activities for the die and mold industry, and the DOST-MIRDC's initiative on setting up a testing facility for locally made aerospace products, to name a few.

News about the celebration of the 2017 Metals and Engineering (M&E) Week were featured in radio news programs. The HERT, the HET, the Auto-parts Testing Laboratory, as well as the conduct of the 2017 National Science and Technology Week (NSTW) in July and the 'MIRDC Goes to the Municipality' held in La Union in October, were the Center's projects and activities that earned slots in the news shown on DOSTv and in local TV channels.

Participation in Exhibits

The TIPS has grown adept at featuring MIRDC-developed technologies and service facilities to exhibitions in various places across the country. In 2017, the DOST-MIRDC, through the TIPS' proactivity and assertiveness, was able to participate in a total of 14 exhibitions.

Engr. Florante A. Catalan (L) discusses about the Autoparts Testing Laboratory, and Engr. Rommel N. Coroña (center) talks about the Hybrid Electric Road Train during the interview with the DOSTv. Engr. Reynaldo L. Dela Cruz and Ms. Lina B. Afable (R) talk about the activities lined-up for the 'MIRDC Goes to the Municipality' in an interview with the local ABS-CBN crew.

The TIPS during the conduct of various activities for the 2017 M&E Week (clockwise from top left): ribbon-cutting ceremonies on the opening of the technology exhibits; tour of students in the exhibit area; registration of guests for the exhibits and Open House; technology demonstrations; AGT demo ride; and info-seminars.

Metals and Engineering (M&E) Week

The Center observes the Metals and Engineering Week (M&E) in the month of June. Every year, the TIPS is actively involved in major activities for the M&E Week. The TIPS, therefore, is a prominent mainstay in most of the activities, from conceptualization up to final execution.

The 2017 M&E Week was observed from June 19-22, 2017. The event was filled with informative and exciting activities such as: the Open House, technology exhibits, info-seminars and technology demonstrations, the M&E Conference, AGT Demo Ride, the Skills Competition, and the celebration of the MIRDC's 51st Anniversary/Employees' Day. Thesewere carried out successfully, with the TIPS playing a key role both as front liners and behind-the-scene orchestrator. Amidst the mundane tasks, the TIPS was proactively providing assistance – coordination with project teams, completion of line-up of resource persons, farming out of invitations, following up of attendance of invited guests, lay-outing of exhibit area, production of promotional materials, and coordination with exhibit contractor and both internal and external exhibitors.

2017 National Science and Technology Week (NSTW) and Regional Science and Technology Week (RSTW)

The 2017 NSTW is one of the major exhibitions participated in by the DOST-MIRDC through the TIPS' active involvement. Like all the previous NSTWs, technologies developed and facilities established by the DOST-MIRDC were featured in the DOST-MIRDC booth. In 2017, the NSTW was held from July 11-15 at the World Trade Center in Pasay City. What made the 2017 NSTW different was the use of interactive videos and augmented reality technologies.

Featured in the 2017 NSTW were the DOST-MIRDC's Advanced Transportation Program, as well as the newly-established facilities including the Die and Mold Solution Center, the Gear Making and Assembly Facility, and

(From L to R): Department of Budget and Management Secretary Benjamin E. Diokno visits the DOST-MIRDC exhibit booth; exhibit viewers try the Train Challenge, which is part of the interactive video that promotes the DOST-MIRDC's Advanced Transportation Program; and guest tries on the Virtual Reality goggles to get a virtual tour of the Center's facilities.

The DOST-MIRDC's exhibit booth for the Regional Science and Technology Week held in (clockwise from top left): Cauayan, Isabela; SM Iloilo, Iloilo City; and Robinson's Place, Tacloban City; Zamboanga Peninsula; Kalinga; and Butuan City.

the Auto-parts Testing Facility. The celebration of the NSTW is a much-awaited event not only among Filipino science communities, but also among the public sector, the industry, and the academe. Very much like a melting pot, the NSTW is where all science, technology, and innovation enthusiasts come together and exploit professional and business opportunities. Being a national event, the showcasing of technologies and S&T services increase the public's awareness and appreciation of the relevant role that the DOST plays in the country's march toward progress and raised competitive advantage.

The use of interactive video allowed the DOST-MIRDC to send the message clearly across to all exhibit audiences: we have the capability to design, develop, and maintain mass transportation systems with the use of local technologies. To the delight of the viewers, the videos presented the Automated Guideway transit (AGT) System, the Hybrid Electric Road Train, and the Hybrid Electric Train (HET) in ideal environments being used as mass transportation means. The Virtual Reality technology, on the other hand, made it easier to show to the public what the facilities in the DOST-MIRDC are all about.

The Center was also invited to join in the Regional Science and Technology Week (RSTW) celebrations held in various regions: Robinson's Place, Butuan City in the CARAGA Region from August 8-10, 2017; F.L. Dy Coliseum in Cauayan, Isabela from August 14-18, 2017; SM Iloilo from August 29-31, 2017; simultaneously at Robinson's in Tacloban City, and the Atrium, Limketkai Center in Cagayan de Oro from September 19-21, 2017; PLGU Astrodome in Kalinga from October 2-6, 2017; KCC Mall, General Santos City from October 17-20, 2017; and finally in the Zamboanga Peninsula from November 22-24, 2017.

Industry association-led exhibitions

The TIPS also was behind the active participation of the DOST-MIRDC in exhibits initiated by the industry. The Center's partnership with major industry associations result in invitations to join in exciting activities that present themselves as opportunities for the DOST-MIRDC to promote and disseminate information about its initiatives aimed to enhance the M&E and allied industries' productivity and competitiveness. The TIPS took again put the Advanced Transportation Program and the Gear Making and Assembly Facility to the Philippine Die and Mould Machinery and Equipment Exhibition (PDMEx) sponsored by the Philippine Die and Mold Association, Inc. (PDMA) held at the World Trade Center in Pasay City, and to the Powertrends Exhibition, organized by the Leverage International (Consultants), Inc., held at the SMX in Pasay City.

"MIRDC Goes to the Municipality" held in Calapan, Oriental Mindoro.

MIRDC Goes to the Municipality

In addition to the 2017 NSTW, 2017 RSTW, and the exhibitions spearheaded by the industry, the TIPS proactively conducted technology exhibits in the local government unit (LGU) level through the conduct of the 'MIRDC Goes to the Municipality' activity. In 2017, the Team MIRDC went to the municipality of Calapan in Oriental Mindoro and to San Fernando City, La Union. The objective of the activity is to actively support the metals, engineering, and allied industries in the countryside by bringing to the municipalities the Center's technologies and services, particularly training, consultancy, information dissemination, and technology promotions. To add to these, the Center also conducts a Skills Competition in partnership with the Philippine Welding Society (PWS).

Activities were simultaneously held in the week-long event. The TIPS set up technology exhibits as other staff from the Technology Diffusion Division (TDD) conducted the rest of the abovementioned activities. With the TIPS exerting diligent effort in the promotions of the Center's technologies, the M&E and allied industries in the countryside became more aware of how the DOST-MIRDC can assist them in technology upgrading and in taking advantage of more effective ways of operating their businesses.

Dialogues, Forum, Focus Group Discussion

The Center, with all its research and development, and S&T-related initiatives, goes out of its way to disseminate information and involve the industry in decision-making and direction-charting. Meetings with the industry and all stakeholders are, therefore, essential to ensuring the success of the Center's activities. The Center's successes are built on dependable partnerships with the industry that are made even stronger by open and thoughtful communication.

Round Table Discussion on DOST's Mass Transportation Program, AGT 1.0

The Philippine government has embarked on different programs and strategies to accelerate the growth of economy. However, one thing remains stagnant and might hinder its growth, and that is the perennial problem on traffic. In fact, according to a study conducted by the Japan International Cooperation Agency (JICA), the Philippines is currently losing Php 2.4B a day due to traffic. If no solutions are made, the losses may escalate to Php 6B a day by 2030.

The DOST-MIRDC started the development of the Automated Guide-way Transit (AGT) System in 2010. The AGT is an alternative transportation technology solution that is locally developed, cost-effective, and environment-friendly. It is envisioned to act as a feeder system to existing main rail systems such as the LRT, MRT, and PNR. Since the DOST-MIRDC started embarking on this project, many local government units and investors have expressed interest on adopting the AGT. However, these interests have not translated to further talks and negotiations.

Engr. Tamayo presents the brief history and accomplishments of the AGT.

Mr. Herve Laumond discusses about the AGT's technical aspects.

Engr. Davie Ang echoes that the local manufacturing industry is ready for the AGT's mass production.

To give interested adopters and the riding public a deeper understanding of the AGT and its potential role in providing a long-term solution to the transportation and traffic problems of the country, the Center organized a round table discussion that was participated in by various transportation experts. DOST-MIRDC Executive Director Robert Dizon's opening remarks touched on the overview of the development of the transportation projects of the Center. He mentioned that the conduct of this round table discussion is expected to provide answer to questions about how the next steps of these projects will proceed. The forum was also attended by representatives from the private sector, from government agencies, and from the media. The dialogue proper was moderated by Dr. Aristotle Carandang of DOST-STII.

Four (4) resource speakers were requested to give a discussion on their respective areas of expertise.

Mr. Herve Laumond, Vice-Chairman, Systra Philipines Inc. (SPI), talked about the potentials of the AGT in the Philippines, particularly focusing on technical aspects. Based on the analysis of the SPI, the AGT has every potential to become a feeder system in large urban areas, and a primary system in smaller urban areas. With all this great potential, the SPI recommends that the DOST-MIRDC invest in the development of an integrated transport system, rather than just a rolling stock technology. The SPI further recommends that the Center considers investing on a longer track for the conduct of more rigorous tests, a dedicated testing laboratory for the development of electronic systems and subsystems, and on engaging experts to further the development of an integrated system. Mr. Laumond went on to suggest the engagement of an independent safety assessor (ISA). Once certified, the SPI stated with confidence that the AGT will be ready for commercial operations.

Engr. Davie Ang is a Design Engineer Consultant from the Fil-Asia Automotive and Industries Corp. which is a bus body manufacturing company. Engr. Ang shared with the audience Fil-Asia's conclusion that the country's manufacturing industry is ready to mass produce the AGT based on the availability of facilities and companies who have the necessary skills and experience, the highly-qualified manpower, the tools and equipment which are practically the same as those used in bus fabrication, and materials that are sourced through local suppliers if not locally available.

Mr. Tony Tan's topic is about the prospects of the AGT for the private sector. Mr. Tan is a Project Director of the Prime Asset Ventures, Inc. (PAVI), a potential adopter of the AGT. Although the DOST cannot accomplish the enormous task of developing the rail transport industry alone, Mr. Tan encouraged the DOST-MIRDC to establish the AGT's safety to potential passengers, to meet riders' expectations in terms of the AGT's ability to help solve the country's traffic problems, and to engage state-owned enterprises and the private sector in a partnership for cost- and risk-sharing. On a very positive note, Mr. Tan shared that the PAVI is willing to partner with the DOST to further the development of the AGT.

Last but not the least, Engr. Deo Leo Manalo, the Operations Director of the MRT-3, which is the benchmark technology of the AGT in the Philippines, shed light about the prospects of the AGT for the public sector. Engr. Manalo said that the Philippines needs a lot of

Mr. Tony Tan (L) and Engr. Deo Leo Manalo (R) discuss the private sector's prospects with the AGT's commercialization and the benefits of the AGT's use to the public sector, respectively.

rail systems that will depend on feeder systems to be connected and to make seamless transfer possible. He commended the AGT project team for coming up with a new concept of the track switch, and recommended that the team use knowledge and experience they acquired from the AGT prototype in conducting further tests, and in developing safety standards and more components, particularly traction system, traffic control, and automatic doors.

Overall, the experts emphasized the need for more mass transport system that can act as feeder system or even primary to some smaller cities and municipalities. The AGT developed by DOST-MIRDC is a welcome technology solution that can address the traffic and transport problem of the country, can generate more jobs and provide business opportunities to local industries. Ultimately, we will boost our self-reliance and lessen the dependence of our country to foreign technologies. However, much has to be done in order to complete the system and make it safe and viable mass transport system. The government has taken already the initiative of developing the AGT, the private sector has to support in order to commercialize this technology.

DOST-MIRDC officials and resource persons discuss more details regarding the AGT.

Public-Private Partnership for the People Initiative for Local Government (LGU P4)

In an effort to promote and eventually commercialize the AGT System, the DOST-MIRDC presented the Center's mass transportation projects to the Department of Interior and Local Government (DILG) on April 27, 2017. It is hoped that through the DILG, the AGT can be promoted to various local government units (LGUs). In that meeting, the DILG through the Bureau of Local Government Development (BLGD), promised to invite the DOST-MIRDC in dialogues and forums they organize for various LGUs. One of the newly launched projects of the DILG is the 'Public-Private Partnership for the People Initiative for Local Government (LGU P4).' The program aims to build a stronger partnership between LGUs and the private sector in implementing infrastructure projects and basic services. Modalities are provided to the public-private partnership to enhance local development that will eventually create more jobs and improve the economy. Shown in the table below are the conferences attended by the DOST-MIRDC.

The presentation highlighted the three mass transportation projects, namely: the AGT System, the Hybrid Electric Road Train, and the Hybrid Electric Train. Of the three, the AGT is the most viable community train since it is tailor-fitted to cities and municipalities with narrow roads. It can serve as the primary mass transport system.

Table 7. Promotional activities involving the DOST-MIRDC AGT

Dates	Participants	Venue
June 23, 2017	Regions V and NCR	Metro Manila
June 29, 2017	Regions IV-A and IV-B	Metro Manila
July 13, 2017	Regions CAR and III	Baguio City
July 26, 2017	Regions VI and NIR	Cebu City
July 27, 2017	Regions VII and VIII	Cebu City
August 16, 2017	Region VI	Iloilo City

For the Visayas Conference (Cebu City and Iloilo City), the DOST-MIRDC was joined by its partner investor, the Redis Global Corporation (RGC) represented by Engr. Antonio Tan and Engr. Elisa Santos of the DOST-Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD).

In May 2017, the DOST-MIRDC published a 'Call for Proposal' to find an investor whose responsibilities will include the provision of at least one kilometre test track with no right-of-way issues; the provision of funds to shoulder the cost of construction of the elevated track, including power room and the necessary electrification; and the laying down of concrete plans for the AGT's sustainable development. Only RGC submitted a letter of interest, however the company is still negotiating with LGUs for the possible AGT route. As stated in the Call for Proposal, the RCG agrees to shoulder the Engineering, Procurement, Construction and Funding (EPC+F).

The DOST-MIRDC shared time with Engr. Tan during its presentation in Cebu City and during the 'Regional Consultation cum Business Matching and Workshop on Populating LG P4 Portal' in Iloilo City. Several LGUs expressed interest, particularly from Iloilo City and Iloilo Province. A round table discussion between the DOST-MIRDC, Engr. Tan, and Iloilo LGU representatives happened after the presentation. In that meeting, the LGU representatives discussed their plan of having a mass transport system connecting the Iloilo Airport and the City of Iloilo covering a distance of twenty kilometers and four municipalities. An AGT route is also being explored within Iloilo City and Iloilo province. It was agreed upon that a simple Benefit-Cost analysis will be presented by the DOST-MIRDC to the City Mayor and the Governor. Iloilo LGU shall provide the data required in the analysis.

The DOST-MIRDC still receives several inquiries or interests from other LGUs such as General Santos City, Baguio City, La Trinidad, Cagayan de Oro City through BLGD, Parañaque City, etc. It is just a matter of time before the first AGT is built for commercial use in our local streets. It is in the best interest of the country if these initiatives and efforts come to fruition.

(L to R) Engr. Joey Pangilinan presents the DOST-MIRDC mass transport projects in Iloilo City; Engr. Rodnel Tamayo shares his thoughts on the mass transport projects in front of representatives from Region 4A and 4B LGUs; and Engr. Tony Tan discusses the business aspects of AGT project.

Dr. Danilo N. Pilar, Chief of the DOST-MIRDC's Technology Diffusion Division (TDD), facilitates the FGD

Focus Group Discussion (FGD) for the Welding and Metalcasting Industries

In line with the 2018 Metalworking Industry Study, whose focus is on both the welding and metalcasting industries, the DOST-MIRDC held the FGD on October 19, 2017 at the Germanium Room, 3F Gold Building of the DOST-MIRDC in Bicutan, Taguig City. Invited participants to the FGD were the respondents of the welding and metalcasting industry survey, also conducted in 2017. The TIPS was heavily involved in this activity as they are the group responsible for the conduct of the survey proper, as well as for the publication of the Industry Study Report.

The information gathered from the survey were consolidated and presented to the industry for their comments and further inputs. Active participation of the industry was the most critical factor which led to the success of the initiative. Highlighted during the FGD were the concerns for the welding industry: the suggestion to encourage 'job-sharing,' and to promote application for the DOST's SETUP in the industry's move toward equipment upgrading. For the metalcasting, on the other hand, cited their need for training and their request for government's intervention in terms of lowering cost of raw materials. To this, the DOST-MIRDC informed the industry of the planned establishment of the Foundry Institute at the Center. The proposed facility is seen as a solution to various issues that are faced by many companies in the metalcasting business. All the industry's insightful inputs will be used by the TIPS in coming up with comprehensive Industry Study Reports that will be used as reference by public and private sectors alike in making strategic decisions concerning issues in the welding and metalcasting industries.


The industry representatives contribute valuable inputs to the FGD on welding and metalcasting industries.

Experienced technicians from the Metrology Laboratory of the Instrumentation and Metrology Section perform calibration inside the laboratory (left) and in the field (right).

C. Quality Control and Testing

Instrumentation and Metrology Section (IMS)

The IMS continued its stellar job of serving customers from different industries and other government agencies including the DOST regional laboratories with calibration services requirements. Calibration of instruments is critical in ensuring accuracy in determining industrial parameters in dimensional, physical, and electrical metrology. Accurate instruments enable these companies to provide better service and better products.

The IMS served a total of 703 companies. Most of them came from the metals and engineering industries, particularly the aviation and automotive industries. A total of Php 8.4 million income was generated from the 1,553 external jobs received, and the 8,884 samples served by the IMS.

The DOST-MIRDC's calibration laboratories continued to prove their competence by having satisfactory results on proficiency testing program coordinated by the National Metrology Laboratory (NML) and the Korea Laboratory Accreditation Scheme (KOLAS). Proficiency testing is a method used to demonstrate competency and validate a laboratory's measurement process by comparing its results with the results of a reference laboratory and other participating laboratories. Among the artifacts sent by the NML are glass thermometer, test gauge, and digital multimeter. For the dimensional metrology, the laboratory participated in the interlaboratory comparison on square calibration. The results of the proficiency testing showed that laboratories of the IMS are still at par with other laboratories here and abroad.

The laboratory underwent a Special Assessment conducted by the Philippine Accreditation Bureau (PAB) last December 4 and 5, 2017. From this activity, the following personnel were recommended as approved signatory: Engr. Franz Joseph D. Libao, Engr. Christian M. Ibañez, Mr. Samuel A. Ysit, and Ms. Mary Joy R. Baroña.

The IMS participated in the recent International Organization for Standardization for Plain Bearings (ISO/TC 123) hosted by the Bureau of Philippine Standards (BPS) held at the Diamond Residences, Makati on November 8-10, 2017 through the attendance of Engr. Rommel N. Coroña, Chief of the IMS, and a member of the Philippine delegation to the said activity.

Physical Laboratory Section

The Mechanical Metallurgy Laboratory (MML) accomplished 2,140 jobs in 2017. The MML is involved in the acceptance of 20,000 metric tons of imported steel bar products from China. The Department of Trade and Industries (DTI) approved the release of the said product and is now allowed to be sold to the domestic market.

Engr. Rommel Coroña (seated, center), Chief of the IMS, attends the International Organization for Standardization for Plain Bearings (ISO/TC 123) hosted by the Bureau of Philippine Standards held at the Diamond Residences, Makati.


MML staff receive imported steel bar samples from the customer


MIRDC tests handcuff sample to determine the strength of the new design

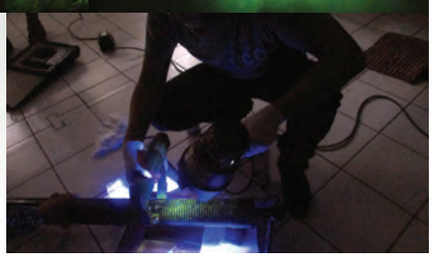
Steel pipe brought by the PNP ordinance group to determine their pressure capacity


Sample refrigerant tanks tested for leaks


The PNP – SAF conducted a research on utility ropes that is capable of withstanding their load requirement


NDT staff perform testing at the ongoing construction of elevator and retrofitting of MIRDC Gold Building



Shown on the above pictures were the firearms that were evaluated like shotgun, caliber pistol, and even mortars used by the Marines in the Battle of Marawi

Police issued items such as handcuffs are tested to determine their capacity. The weakest part of the product was revealed after the test. Above picture is the new design for the link, which is better compared to the old one which is the chain type.

The PNP Ordnance Group created an explosive/bomb out of steel pipe. The steel pipe was tested up to failure to determine its pressure capacity.

Refrigerant tanks were hydraulically tested to determine if the tanks can withstand the designed hydrostatic test pressure. The tanks were inspected for leaks after reaching the test pressure.

For the year 2017, the Non-destructive Laboratory received a total of 141 Technical Service Request, 1,259 samples with an income of Php724,314.00.

Significant boost came in during the second semester of the year where the number of samples doubled compared to the first half of the year, 808 to be exact, with lab personnel still able to finish the tests and release the results within the agreed date. This only shows that even with reduced number of personnel, the laboratory still performed its job with consistency and more efficiency while working beyond regular office hours. Most of the jobs received this year have a significant impact on the field

Ultrasonic testing of rail thermite welded joint at MRT depot

of transportation. The NDT performed weeks of testing, specifically rail inspection, at the MRT Depot. Personnel were also trained from LRMC (Light Rail Manila Corp.) - the company currently handling the operations and maintenance of LRT Line 1.

Tests were also conducted as support activities to some projects of the Prototyping Division such as for the AGT spreader and the baler body and frame. Likewise, testing were also conducted for the propeller shaft weld and suspension support of the train set project, as well as for the welded frame of the elevator which is presently being constructed in the DOST-MIRDC Gold Building.

Support to Other Government Agencies

The DOST-MIRDC continuously supports the BPS's product standardization through membership to their Technical Committees (TC), whose main objective is to improve safety and product quality. The Analysis and Testing Division (ATD) personnel who are members of certain BPS-TC are as follows:

a. Gina A. Catalan - BPS/TC 54 (Jewellery) and TC 61 (Ferrous Pipes and Fittings)
b. Florante A. Catalan – TC 44 (Road Vehicles)
c. Eduardo D. Malit – TC 6 (LPG Cylinders)

The assistance of the DOST-MIRDC to the Philippine Accreditation Bureau (PAB) was also commendable. The ATD personnel who were tapped as Technical Assessors for the accreditation of private testing and calibration laboratories are: Chemical Testing - Gina A. Catalan; Mechanical Testing - Florante A. Catalan, and Calibration – Rommel N. Coroña, Arlene G. Estacio, Christine P. Avelino.

10th Meeting of BPS/TC 54 held on 24 Oct. 2017 at BPS Conference Room, DTI Head Office, Makati City; TC Members were given recognition by BPS during the "BPS Technical Forum 2017" held last 12 Oct. 2017 at F1 Hotel Manila, Global City

IBC Transmission Tower which underwent non-destructive test using pXRF

PCL staff conduct on-site chemical analysis on gears used by a fertilizer company in Cebu.

Analytical Laboratories Section

The Analytical Laboratories Section (ALS) maintained its exceptional performance this year by serving 849 job requests with 2,863 samples, where about 53% of the samples were tested using the Optical Emission Spectrometer (OES) and comprised mainly of Bureau of Philippine Standards (BPS) regulated products. This accomplishment was realized despite the suspension of some of its testing services as the Physico-Chemical Laboratory underwent major rehabilitation for the continuous improvement of their services.

The ALS introduced in the last quarter of 2016 the on-site testing using a portable X-ray Fluorescence Spectrometer (pXRF), which aims to conduct a non-destructive test that will determine the chemical composition of large metal samples and fixtures, among others. The testing service went full blast this 2017. One of the clients was a television network located in Quezon City that had their transmission tower tested (see photo). The said service also offered 'one-day testing' and conducted a total of 26 jobs for the whole year.

The ALS's support and assistance to various M&E industries and other government and non-government sectors also continued. One of the highlights this year is their assistance to the Philippine National Police (PNP) in their bidding for ammunition through the conduct

DOST delegates pose during the "International Research Equipment Expert Course" held in South Korea

MIRDC Participates in the Technology Transfer Day (Zen Hotel, Isabela, August 2017)

of material testing on 9mm. caliber pistol. ALS personnel also actively took part in the material testing for the project entitled, 'Design and Optimization of Austenitic Liner of the Philippine Aggregates and Mineral Processing' under the Materials and Process Research Division.

To cap off the year, Engr. Gina A Catalan, Jo Marie Venus T. Agad, and Morris D. Pioquinto were recommended as approved signatories for chemical testing during the ALS's re-assessment by the Philippine Accreditation Bureau (PAB) last Dec. 19-20, 2017. This just shows the Section's commitment to provide the best services as they raise the bar for excellence in testing services.

Two ALS personnel, Mr. Morris D. Pioquinto and Mr. Glenn R. Dioneda, participated in a two-week seminar held in Sungkyunkwan University, South Korea in January 2017, as part of DOST-PCIEERD's 'Bridging the Human Resources Competency Gaps in Support of National R&D Agenda' project. The seminar aims to guide the participants with basic repair and maintenance of different scientific equipment.

D. Technology Transfer Projects Implemented

The DOST-MIRDC, through the Technology Advisory and Business Development Section (TABDS), sharpened its focus on the technology transfer of its research and development outputs and other metal sector-related technologies to the industry and other interested parties through the conduct of information dissemination and promotion activities including consultancies and trainings.

Technology Transfer Day (Widus Hotel, Clark, Pampanga, 11 Dec. 2017)

Among the highlighs of the technology transfer activities conducted by the DOST-MIRDC is the 1st MIRDC Technology Transfer Day held on 21 June 2017 in conjuction with the 2017 M&E Week celebration. Researchers gave pitch decks to interested fabricators of the various DOST and MIRDC-developed technologies. The activity also provided the fabricators an opportunity to discuss with the respective project teams the special features of the technology of interests.

The DOST-MIRDC also participated in the Technology Transfer Day in Cebu City, Santiago City, Cagayan De Oro City, Iloilo City, and Clark in Pampanga. The Center was also a participant in the

Techno Caravan held in Antique. The Technology Transfer Day is an activity spearheaded by the DOST-Technology Application and Promotion Institute (DOST-TAPI) and is participated in by various DOST RDIs, other government organizations, public and private universities, and inventors who received DOST fundings for their R&D activities.

The DOST-MIRDC featured seventeen (17) technologies during the MIRDC Technology Tranfer Day, namely: Water Retort, Vacuum Fryer, Spray Dryer, Freeze Dryer, Superheated Steam Treatment System, Microwave Vacuum Dryer, Rice Transplanter Attachment for Hand Tractors, Rice Harvester Attachment for Hand Tractors, Rotary Press for Abaca "Pinukpok" Fabric, Pandanus Slitter-Presser, Tikog-Press Machine, Trash Rake, Tent System, Micro-cupola, Road Train (CRT), Hybrid Electric Road Train (HERT), and the Automated Guideway Transit (AGT). Only selected technologies were featured in the Technology Transfer Day held in the regions. As a result of the activities, a total of fifty five (55) term sheets were received from various interested equipment fabricators that correspond to an intent to license the technology. The term sheet serves as an initial agreement between the DOST-MIRDC and the interested fabricator on the corresponding fees and other conditions set by said parties.

In 2017, a total of six (6) licensing agreements were forged: two (2) licensing agreements between the DOST-MIRDC and VIRCAP Light Metal Industries (Bohol) for the LPG Fired Spray Dryer and Vacuum Fryer equipment, and four (4) licensing agreements between the DOST-MIRDC and Agricomp Machineries and Construction Corporation (Isabela) for the Water Retort, Vacuum Fryer, Spray Dryer, and Freeze Dryer equipment.

Intellectual Property (IP) Management

As the country pushes towards the increasing knowledge-driven economy, the DOST-MIRDC acknowledges the importance of effective Intellectual Property (IP) Management through the implementation of the DOST IP Policy (DOST Administrative Order No. 004). The TABDS, which also functions as the Technology Licensing Office of the Center, continued to enhance its assistance and guidance to increase the number of IPs of the Center, be it in the category of invention utility model, trademark, or innovation.

In 2017, the Center applied for a total of seven (7) IPs.

Table 8. Summary of corresponding IP applications of the DOST-MIRDC in 2017

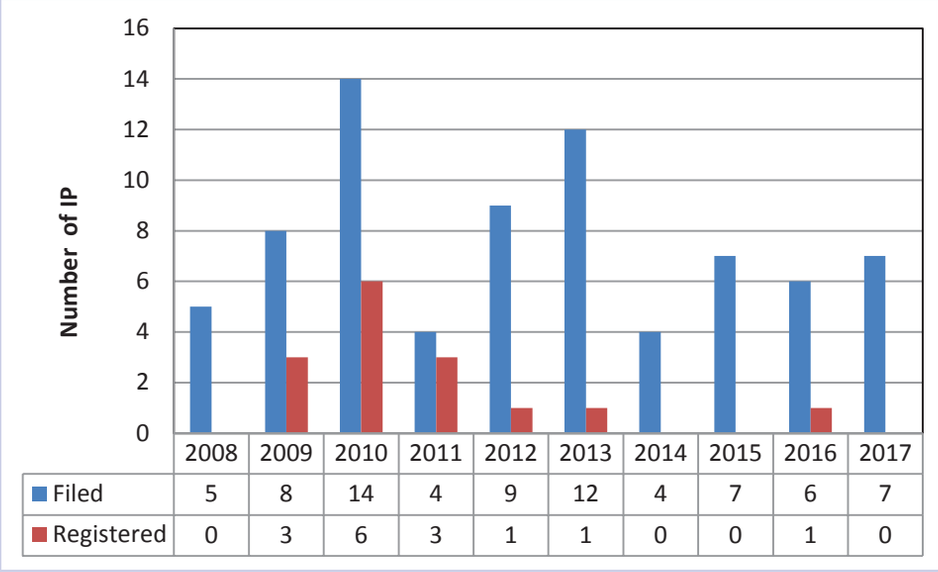
Title of IP Filed	Type	Registration No.	Researchers
System of Assembling a Combined Harvester and Thresher Attachment to Handtractor and Attachment Therefrom	Patent	12017000129	Engr. Isidro D. Millo Engr. Ronie S. Alamon Engr. Emerito V. Banal Raymond S. De Ocampo Laureano L. Dalay
Sugarcane Stripper	Invention	12017000221	Engr. Emerito V. Banal Engr. Ronie S. Alamon Engr. Isidro D. Millo Raymond S. De Ocampo
Sugarcane Loader	Utility Model	22017050144	Engr. Emerito V. Banal Engr. Ronie S. Alamon Engr. Isidro D. Millo Raymond S. De Ocampo

Table 8. Con't.

Title of IP Filed	Type	Registration No.	Researchers
Sugarcane Cutting System	Invention	12017000238	Engr. Emerito V. Banal Engr. Ronie S. Alamon Engr. Isidro D. Millo Raymond S. De Ocampo
Road Train	Invention	12017000254	Engr. Robert O. Dizon Dr. Rio S. Pagtalunan Engr. Rommel N. Coroña Engr. Arlene G. Estacio Engr. Jorge Arbie V. Garcia Engr. Elljay P. Mutuc Engr. Alvin M. Buison Engr. Franz Joseph D. Libao Engr. Godfreyson J. Nardo Engr. Christian Glenn S. Ligon Engr. Alexander M. Argame jr.
Hybrid Electric Train	Invention	12017000382	Engr. Robert O. Dizon Engr. Pablo Q. Acuin Engr. Jonathan Q. Puerto Engr. Rodnel O. Tamayo Engr. Glen D. Espena Engr. Ulysses B. Ante Engr. Jorge Arbie V. Garcia Engr. Franz Joseph D. Libao Rolando F. Ibuig Engr. Carla C. Nocheseda Engr. Nelson L. Tumibay Engr. Geofrey L. Abulencia Engr. Florentino J. Lafuente

Table 8. Con't.

Title of IP Filed	Type	Registration No.	Researchers
Anti-Climbing Device with Energy Absorber for Railways Trains	Invention	1 2017 000 381	Engr. Robert O. Dizon Engr. Pablo Q. Acuin Engr. Jonathan Q. Puerto Engr. Rodnel O. Tamayo Engr. Glen D. Espena Engr. Ulysses B. Ante Engr. Jorge Arbie V. Garcia Engr. Franz Joseph D. Libao Rolando F. Ibuig Engr. Carla C. Nocheseda Engr. Nelson L. Tumibay Engr. Geofrey L. Abulencia Engr. Florentino J. Lafuente



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Filed	5	8	14	4	9	12	4	7	6	7
Registered	0	3	6	3	1	1	0	0	1	0

Figure 2. Number of IP filed and registered, 2008-2017

E. Business Economic Advisory

A total of four hundred nine (409) technical consultancy and assistance services to three hundred (344) individuals, organizations, and offices were provided by the Center's technical experts, mainly through the initiatives of the TABDS. Consultancy services addressed clients' concerns on various areas such as heat treatment, electroplating, welding, fabrication, metalcasting, metalworking processes, testing and analysis, calibration, and quality management systems, among others.

For 2017, majority of the M&E clients of the DOST-MIRDC's technical consultancy and assistance services came from the food manufacturing industry. This is not surprising, since the Center has worked closely with other DOST

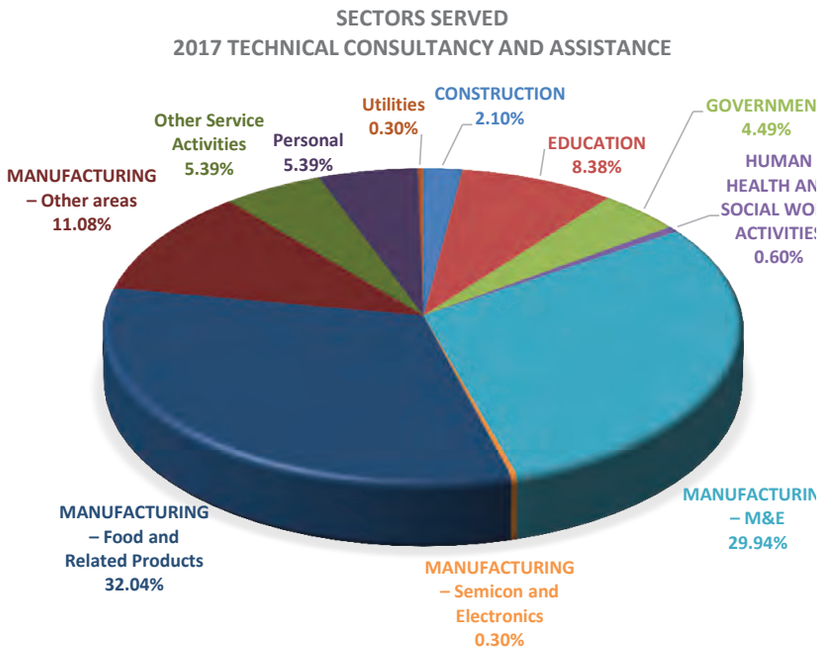


Figure 3. Sectors served in 2017 through the Technical Consultancy and Assistance Services of the DOST-MIRDC

agencies and the Department of Agriculture (DA) for the past years on projects related to food production and sustainability. Collaborations with various government agencies promoted the DOST-MIRDC's expertise in providing assistance in the fabrication of different food processing equipment.

The DOST-MIRDC has maintained its ISO 9001 certification for the more than 10 years now, and thus advocates its establishment and maintenance among M&E firms and other government agencies, including the transition from ISO 9001:2008 to ISO 9001:2015 version. DOST-attached agencies such as the DOST-Philippines Nuclear Research Institute (DOST-PNRI) and the DOST- Philippine Textile Research Institute (DOST-PTRI), as well as private companies in the M&E industries, namely: RU Foundry and Machine Shop and Aurochs Aerospace Precision Manufacturing Corporation

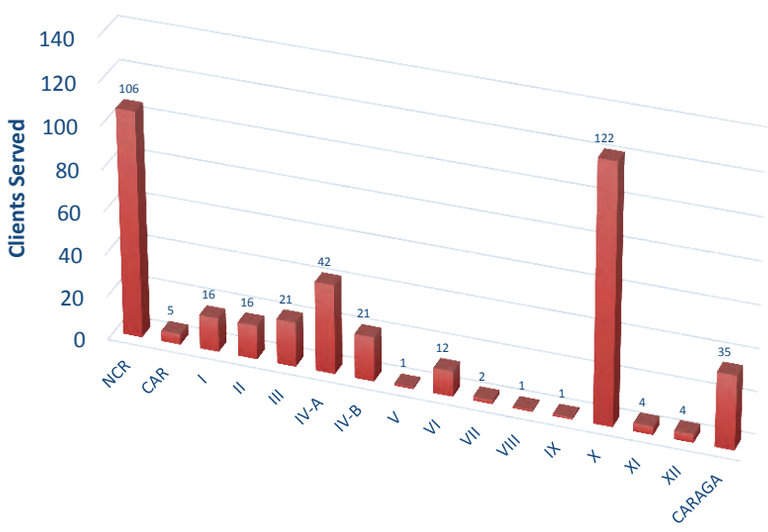


Figure 4. Clients served by region through the Technical Consultancy and Assistance Services in 2017

(Left) RU Foundry and Machine Shop Corporation, Bacolod City: Certification Audit for Quality Management System based on ISO 9001:2015, February 2017.
(Right) Metallic Pisces Engineering Works, General Santos City: Consultancy on Foundry Operations, July 2017

availed of the DOST-MIRDC's assistance in the conduct of review and improvement of their documented information, particularly on risk management which is a specific requirement of the 2015 version.

The DOST-MIRDC was also part of the initiative of the DOST Central Office (DOST-CO) to establish their quality management system based on ISO 9001:2015. As this was a very important journey for the DOST-CO, the DOST-MIRDC was there to assist them through the conduct of the orientation and Internal Quality Audit (IQA) seminars and a series of technical consultancy activities. The orientation seminar aimed to inculcate to the Management and staff the requirements of the Standard; the IQA seminar was intended to familiarize them with the preparation, implementation, and report writing as part of the internal audit process; and the series of technical consultancy services was a way to prepare and assess the agency's QMS readiness for certification. The QMS consultancy activities were spearheaded by Dr. Danilo N. Pilar, Ms. Linda G. Rivera and Engr. Mervin B. Gorospe.

Other Services and Facilities

Automotive Testing Laboratory

The Automotive Testing Laboratory (ATL), the newest laboratory of ATD, underwent external audit from the Philippine Accreditation Bureau (PAB) for the accreditation of the Zwick 200T UTM on December 19, 2017. The ATL already has a total of 450 internal and external job orders with a total income of Php246,225. A notable job done was the vibration testing and simulation for an electronic company to test their LCD monitors with built-in CPUs (thin client product).

Some of the newly bought hi-tech equipment of the ATL

HUMAN and FINANCIAL RESOURCE MANAGEMENT

The Center's highly motivated and sincerely appreciated workforce are key to making all our achievements possible. Team MIRDC is nurtured so that it functions at its best because it thrives in a friendly workplace culture and is given the most supportive environment – settings which do not just happen by chance. Thus, the DOST-MIRDC recognizes its ever-dependable Finance and Administration Division for the skillful and strategic management of the Center's human and finance resources.

The MIRDC Human Capital

For the year 2017, the Metals Industry Research and Development Center(MIRDC) was able to sustain a total of 214 technical and non-technical personnel. This included several manpower movement that resulted to the confernment of six (6) new appointments, nine (9) promotions and four (4) separations due to retirement.

The MIRDC's Human Capital is distributed as follows:

		Research and Development			Technical Services		
	OED	MPRD	PD	PMD	ATD	TDD	FAD
Engineers	3	10	16	1	14	13	3
Non-Engineers (Technical)		18	23	13	19	3	
Admin/Support/Non-Technical	3	5	7	4	3	17	39

The Center extends its warm Welcome and Congratulations to its newly-hired and promoted personel:

New Personnel:

Joel B. Narvaez
Administrative Aide III
Finance & Administrative Division

Maricar R. Macaraeg
Administrative Officer II
Finance & Administrative Division

Rowena D. Mabanglo
Administrative Assistant I
Office of the Executive Director

Mary Grace B. Opon
Administrative Officer I
Finance & Administrative Division

Nestor Q. Colibao, Jr.
Engineer I
Finance & Administrative Division

Bryle M. Magat
Laboratory Technician I
Analysis & Testing Division

Promoted Personnel:

Ma. Alicia B. Cabral
Administrative Officer IV
Finance and Administrative Division

Norma B. Garcia
Administrative Officer V
Finance & Administrative Division

Ma. Rodessa Grace A. Mercado
Planning Officer II
Planning and Management Division

Reynaldo O. Bayot
Engineer II
Finance and Administrative Division

Arvin Yan V. Pacia
Senior Science Research Specialist
Analysis and Testing Division

James Asher B. Cabarloc
Science Research Specialist II
Analysis and Testing Division

Arby F. Coria
Science Research Specialist II
Prototyping Division

Christian D. Brual
Metals Technologist III
Materials and Process Research Division

Jyrwen A. Ayao
Metals Technologist III
Materials and Process Research Division

One last fun shot with Ate Jay – FOR KEEPS!

Name	Position/Division	Years of Service
1. Ernesto S. Sambo	Metals Tech IV MPRD	34 Years
2. Wilfredo M. Ramillo	Metals Tech IV PD	43 Years
3. Felicisimo J. Mercado	Administrative Aide VI MPRD	29 Years
4. Jaysay L. Bactad	Administrative Officer IV FAD	27 Years

Furthermore, MIRDC duly recognizes the service rendered and the valuable contribution of its outgoing personnel.

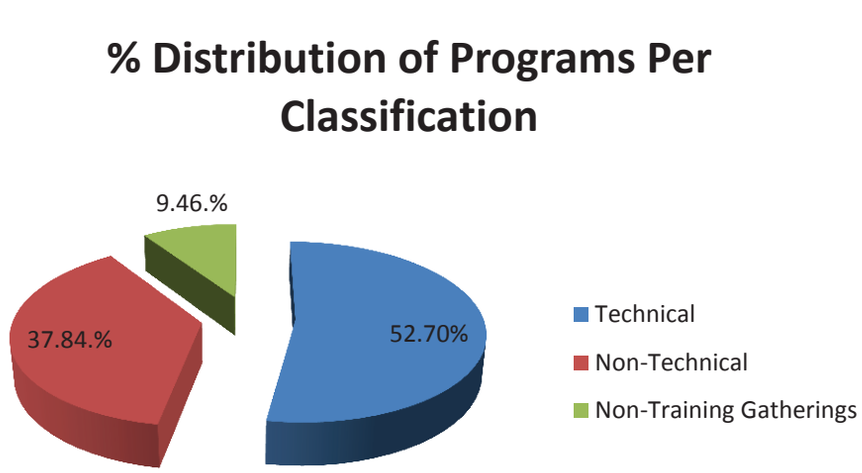
FAD's tearful send-off to Jaysay "Ate Jay" Bactad graced by Engr. Robert O. Dizon who awarded her a Plaque of Service Recognition.

MPRD's send-off celebration for their retirees Felicisimo "Boy" Mercado and Ernesto "Ka Inying" Sambo with the Top Management who awarded them with a well-deserved Plaque of Service Recognition.

Annual Learning and Development Programs

The Finance and Administrative Division's Admininistrative and General Services Section (FAD-AGSS) has once again surpassed its Annual Learning Development Plan (ALDP) target with a total acomplishment of a 123.33%. From the sixty (60) ALDP target programs, a total of seventy four (74) local training programs were implemented. This is exclusive of the sixty (60) unplanned local and foreign training programs facilitated by FAD-AGSS during the year.

Programs implemented were classified as Technical (39 programs), Non-Technical (28 programs) and Non-Training Gatherings (7 programs) . The percent distibution based on the total 74 programs implemented is illustrated as follows:



Highlights of the MIRDC Learning and Development Programs

The attainment of the Annual Learning and Development Plan's target for 2017 is attributed to the contribution of the Center's Subject Matter Experts (SME) in conducting a total of fifteen (15) In-House training programs. In recognition of their commitment and dedication, MIRDC salutes these contributors:

Subject Matter Expert	Training Program/s Conducted	Date Conducted
Dr. Danilo N. Pilar	ISO 9001:2015 Risk Management	January 13, 2017 February 24, 2017
Engr. Charles Edward L. Alviar	Uncertainty of Measurement	February 9, 2017
Atty. Trixie Hazel C. Veluz	Orientation on Statement of Assets, Liabilities and Net-Worth (SALN)	February 15, 2017
Ms. Mary Joy M. Bautista Ms. Maria Luisa A. Fajarda	Orientation on Chemical Spillage Response and Clean-up	February 16, 2017
Engr. Florante A. Catalan	Workplace Safety	March 21, 2017
Ms. Jocelyn F. Dime Ms. Ma. Elena G. Gurimbao Dr. Concesa T. Cortez	Trainers' Training Program	March 27-29, 2017
Mr. Diddier B. Sibal	MS Excel	March 30-31, 2017
Ms. Ma. Rodessa Grace A. Mercado	Questionnaire Design and Statistical Analysis	April 17-19, 2017
Mr. Francis Albert M. Ferrer	MS Powerpoint	May 10-11, 2017
Dr. Rio S. Pagtalunan Engr. Gina A. Catalan	ISO/IEC 17025 Awareness ISO/IEC 17025 Internal Audit	May 23, 2017 May 30-31, 2017
Engr. Ronie S. Alamon	SMAW	July 5-7, 2017
Engr. Florentino J. Lafuente	Basic Foundry Practices	Aug. 1-3, 2017
Engr. Rodnel O. Tamayo	Orientation/Re-Orientation MIRDC EMS Programs	Aug. 18, 2017
Engr. Rommel N. Coroña	Introduction to Uncertainty Measurement Analysis	Sep. 4, 2017

Dr. Rio S. Pagtalunan delivers his lecture on ISO/IEC 17025 Awareness conducted on May 23, 2017.

Engr. Gina A. Catalan assists the participants during the workshop on ISO/IEC 17025 Internal Audit Seminar on May 30-31, 2017.

Mr. Camilo C. Cariaga assists SMAW participants during the hands-on activities on July 5-7, 2017

Engr. Florentino J. Lafuente conducts the the the demonstration part of the Basic Foundry Practices held last August 1-3, 2017

Added to this were the ten (10) customized training programs conducted by outsourced training providers funded by MIRDC, DOST-Human Resource Development Program (HRDP) and the different on-going Research & Development Projects of the Center.

	Program Title	Training Provider	Source of Fund	Date Implemented
1.	Variable Frequency Drive	DAC Industrial	Performance Testing of 5-Coach Hybrid Electric Road Train for Local Application	January 13, 2017
2.	MEAN 2.0 Stack - Intermediate Level	RM Bright Multimedia	Establishment & Strengthening of ICT Infrastructure & Business On Line Solution System of the Center in Support to the Productivity and Competitiveness of the M&E Industries	March 13-17, 2017
3.	Strategic Planning - Management Tools	Jocelyn Linsao-Ng	MIRDC-ALDP	April 10-12, 2017
4.	AS 9100:2016 Rev D Risk Management Training B1 & B2	NQA Phils	Supporting Philippine Companies in the Preparation and Implementation of an Aerospace Quality Management System (AQMS) aligned with AS9100 Requirements	May 29-30, 2017 May 31-June 1, 2017

	Program Title	Training Provider	Source of Fund	Date Implemented
5.	Understanding the ISO/IEC 27001:2013 ISMS	Neville Clark Phils.	Establishment & Strengthening of ICT Infrastructure & Business On Line Solution System of the Center in Support to the	August 29, 2017
6.	Documenting and Implementing ISO/IEC 27001:2013 ISMS	Neville Clark Phils.	Productivity and Competitiveness of the M&E Industries	August 30-31, 2017
7.	EMS Internal Audit	Synergized Macro Solutions Inc.	MIRDC-ALDP	October 3-4, 2017
8.	Scientific Writing for DOST Researchers	Dr. Genaro Japos IAMURE-	DOST-HRDP	November 6-10, 2017
9.	Values Orientation Workshop	Civil Service Commission (CSC)	MIRDC-ALDP	November 27-29, 2017
10.	Leveraging R&D Human Resource through HR Analytics	Personnel Management Association of the Phils. (PMAP)	DOST-HRDP	December 11-12, 2017

The DOST-Human Resource Development Program (HRDP) approved the implementation of two (2) Learning and Development Programs, namely: (1) Scientific Writing for DOST Researchers; and (2) Leveraging R&D Human Resources through HR Analytics.

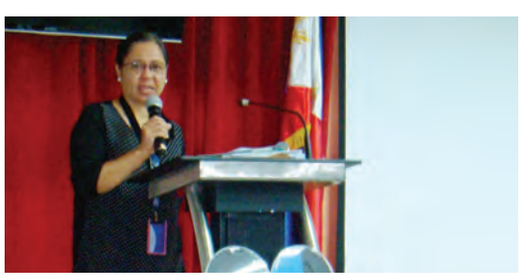
On November 6, 2017, the 5-day Training Workshop on Scientific Writing for DOST Researchers officially commenced with MIRDC's Executice Director, Engr. Robert O. Dizon, delivering the opening message at thePlatinum Auditorium. Aside from our twenty-five (25) technical and non-technical personnel, a total of twelve (12) participating researchers from the different agencies attended the program. These agencies were the DOST-Special Projects Division, DOST Regional Offices I, III, VI and XI, as well as ASTI and ITDI. This was conducted by Dr. Genaro V. Japos, Founder and President of the IAMURE Multidisciplinary Research and the Philippine Association of Institutions for Research, Inc

The write-shop intensive program enabled the participants to immerse themselves in the use of the latest editing tools and softwares that are available in the world-wide web. Twenty five (25) publishable papers and journals were subjected in the latest editing softwares such as Google Scholar Citation, ORCID, Mendeley and Perish. Valuable insights were also imparted by Dr. Japos based on his extensive experience in scientific research writing that were highly appreciated by the participants.

These inputs together with the discovery on the use of the editing tools created an impact among our researcher-participants that garnered an overwhelming positive feedback.

Engr. Robert O Dizon, who officially opened the program, poses with the resource speaker, Dr. Genaro V. Japos.

DOST Researchers perform an unfreezing activity.



Ms. Aurea T. Motas, Chief of FAD, delivers the closing remarks after the awarding of certificates.

Engr. Dizon and Dr. Japos with the participants of the Training Workshop on Scientific Writing for DOST Researchers in their candid pose.

For its second DOST-HRDP funded training program, FAD-AGSS implemented the Leveraging R&D Human Resource Through HR Analytics last December 11-12, 2017. The program was participated in by HR Leaders, Administrative Officers and Supervisors from eigth (8) DOST agencies,such as DOST Regions I, II, XIII, PCHRD, PCAARRD, FPRDI, PHIVOLCS and PSHSS. The program introduced the different HR Analytics tools that can be used by HR Practioners in measuring the key result areas of the HR processes.

From L-R: Jon Alvin Jacinto of DOST Region II exchanges ideas with our MIRDC delegates Engr. Isidro Millo, Dolly Marie Borlado, Laila Porlucas and Ma. Rodessa Grace Mercado during the brainstorming activity.

Ms. Charmaine S. Valdes of PMAP delivers a lecture on HR Analytics conducted on December 11-12, 2017.

Adelina Jimenez of PCAARRD and Buenalivia Olatan with Donavie Flores of PCHRD teams up with Ms. Rosario Sancon of MIRDC during group exercises.

From L-R, Fe Frialde of FPRDI, Bernie Paulo Tangente with Herpert Briones of PSHSS, Imelda Mezo of DOST Region XIII and Jasmin Bañez of DOST Region I finalize their output prior to presentation.

Participants who successfully finished the seminar on Leveraging R&D Human Resource through HR Analytics.

Aside for the planned learning and development programs, the FAD-AGSS facilitated nineteen (19) foreign travels and thirteen (13) scholarship programs. Table A-1 shows the detailed List of Foreign Training and Non-Training Programs implemented while Table A-2 is the Summary of New and On-Going Scholarship Programs CY 2017.

Table A-1. List of Foreign Training and Non-Training Programs CY 2017

Name of Participants	Title of Program	Date Conducted		Venue	Sponsor	Nature
		From	To			
Morris DR. Pioquinto Glenn R. Dioneda	Technicians' and Engineers' Training on R&D Facilities and Equipment Maintenance and Repair	01/08/2017	01/21/2017	Republic of Korea	Bases Conversion and Development Authority	Training
Simplicio N. Morla Arby F. Coria	Training on Hypermill CAM Sofware (5-axis)	01/16/2017	01/20/2017	Singapore	Gaylan Technologies, Equipment, Machineries and Supplies	Training
Robert O. Dizon Jonathan Q. Puerto Fred P. Liza Jayson P. Rogelio	Study Mission for the Establishment of Advanced Mechatronics and Robotics (AMEROB) Facility	01/18/2017	01/31/2017	Japan, Taiwan, Thailand and Spain	PCIEERD - Human Resource Development Program (HRDP)	Study Mission
Reynaldo L. Dela Cruz, Jr.	Asian Welding Federation Constitution Review Meeting	02/27/2017	03/01/2017	Singapore	Philippine Welding Society	Meeting
Felipe G. Pachoco	Varin Food Machinery and Seal Precision Can Seamer Basic Operation and Trouble Shooting Class	03/02/2017	03/05/2017	Thailand	Dyna Flow Industrial Supply	Training
Rey N. Mariposque	Capacity Building Study Tour for the Project entitled "Elaboration of Industrial Promotion Plans using Value Chain Analysis."	03/28/2017	04/06/2017	Thailand	DTI-BOI and JICA	Capacity Building Study Tour
Joseph Alfred V. Garcia Allan John S. Limson	KISSsys Training for Gearbox Design and Optimizatoin	04/02/2017	04/09/2017	Switzerland	IPSYSTEMS/DGIA Project/EES KISSsoft GmbH, Switzerland	Training
Reynaldo L. Dela Cruz, Jr.	27th Asian Welding Federation (AWF) Workshop Meeting and Te4chnical Forum/Viet Nam Welding Society (VWS) Congress	04/18/2017	04/20/2017	Viet Nam	Philippine Welding Society (PWS)	Meeting
Jonathan Q. Puerto Rodnel O. Tamayo Joey G. Pangilinan Pablo Q. Acuin	Machine Buy-Off of Vacuum Carburizing Equipment	05/23/2017	05/26/2017	India	ALD Dynatech Furnaces PVT. LTD of India/Gecar Machine Solutions, Inc.	Machine Buy-Off
Nelson L. Tumibay Jojit M. Velasco Serafin G. Aguilar	Training on Vacuum Carburizing Equipment	05/29/2017	06/02/2017	India	ALD Dynatech Furnaces PVT. LTD of India/Gecar Machine Solutions, Inc.	Training
Rey N. Mariposque	Capacity Building Study Tour for the Project entitled "Elaboration of Industrial Promotion Plans using Value Chain Analysis."	06/18/2017	06/27/2017	Japan	JICA and DTI-BOI	Capacity Building Study Tour
Lemuel N. Apusaga	Orientation on the Operation and Maintenance of Bottom Pour Ladle	06/20/2017	06/23/2017	India	PCIEERD-GIA Project	Orientation
Nelson L. Tumibay	2nd Symposium on Failure Analysis and Inspection for Materials and Products of ASEAN Countries (as international guest speaker)	08/16/2017	08/18/2017	Thailand	Thailand Institute of Scientific and Technological Research	Symposium
Agustin M. Fudolig/ Carla Joyce C. Nocheseda	Meetings and Test Works for PCIEERD-DTI funded project entitled "Technical and Economic Feasibility Study to Determine the Most Suitable Ironmaking Technology for the Value Adding of Philippine Magnetic Resources"	08/20/2017	08/28/2017	Germany & Austria	PCIEERD-DTI funded project/Outotech GinbH/Primetals Technologies	Meeting
Agustin M. Fudolig	AEROMART Nagaoya 2017 Exhibit (as guest speaker)	09/26/2017	09/28/2017	Nagoya, Japan	DTI funded project entitled "Supporting Phil. Companies in the Preparation & Implementation of an Aerospace Quality Mgt. System, (AQMS) Aligned with AS 9100 Requirements"	Exhibit

Table A-1 Con't.

Name of Participants	Title of Program	Date Conducted		Venue	Sponsor	Nature
		From	To			
Danilo N. Pilar	2nd Trade Mission of the Phil-Japan Small Medium Enterprises (SME) Council of the Philippine Chamber of Commerce and Industry (PCCI)	08/27/2017	08/30/2017	Osaka, Japan	MIRDC Regular Funds	Mission
Adonis T. Marquez	Knowledge Co-Creation Program: Know-How of Monozukuri at Japanese Mfg. Site-Productivity Improvement & Facility Maintenance Mgt.	10/22/2017	07/12/2017	Kyushu, Japan	JICA	Training
Jonathan Q. Puerto Rodnel O. Tamayo Joey G. Pangilinan Franz Joseph Libao	Study Mission & Benchmarking in the Design of AGT	10/23/2017	10/28/2017	South Korea	AGT -UP Diliman Project	Study Mission
Fred P. Liza Joseph Alfred V. Garcia Allan John S. Limson Joein L. Luces	Training on Advanced Manufacturing System and Gear Box Technology	12/18/2017	12/23/2017	South Korea	Establishment of a Gear Making And Assembly Facility Project	Training

Table A-2. Scholarship Programs CY 2017

I. Doctorate Degree Program

	Name of Scholar	Program/Course	Duration of Contract	School/ University	Type of Scholarship	Scholarship Status	Grantor
1	Estacio, Arlene G.	Doctor of Philosophy in Electronics Engineering	SY 2015, 2nd Qtr - 2018	Mapua Inst. of Technology	Full Time / Local	On-going	DOST-HRDP

II. Master's Degree Program

1	Asmado, Louren Joy G.	Master of Technology	Nov 2015 - Oct 2017	TUP Manila	Full Time / Local	On-going	DOST-HRDP
2	Bathan, Gharry M.	MS in Mechanical Engineering	Nov 2014 - Oct 2016	TUP Manila	Part Time / Local	On-going	DOST-HRDP
3	Bautista, Mary Joy M.	Master of Science in Chemistry	June 2016 - June 2020	UST	Part Time / Local	On-going	DOST-HRDP
4	Bedis, Sheena S.	Master of Arts in Economics	June 2015 - Aug. 2017	PUP Manila	Full Time / Local	On-going	DOST-HRDP
5	Ibañez, Christian M.	Master of Science in Electrical Engineering	June 2016 - June 2019	TUP-Manila	Part Time / Local	On-going	DOST-HRDP
6	Limson, Allan John S.	MS in Mechanical Engineering	June 2014 - May 2017	TUP Manila	Part Time / Local	On-going	DOST-HRDP
7	Luces, Joein L.	Master of Science in Mechanical Engg	Jan 2016 - Dec 2020	Mapua Inst. of Technology	Part Time / Local	On-going	DOST-HRDP
8	Rafanan, Marlene R.	Master in Business Administration	Dec 2017 – Dec 2019	San Beda Alabang	Full Time / Local	Contract in process	DOST-HRDP
9	Rivera, Linda G.	Master in Business Administration	AY2016-2018	Pamantasan ng Lungsod ng Maynila	Full Time / Local	On-going	DOST-HRDP
10	Viernes, Mildred V.	Master of Information Technology	SY 2nd Sem/Nov 2010 - Mar 2013 (2.5 yrs)	UPLB	Full Time / Local (Residential)	On extension	ASTHRDP (DOST-SEI)
11	Nocheseda, Carla Joyce C.	Master in Material Science and Engineering	Sept 11, 2017-Sept 30, 2018	Univ. of Sheffield, UK	Full Time / Foreign	On-going	Chevening Scholarship

III. Graduated Scholar

1	Catalan, Florante A.	Master of Science in Mechanical Engineering	AY 2013 - 2014	TUP Manila	Full Time / Local	On 2nd extension	DOST-HRDP

Personnel & tenants who evacuated the Gold Bldg. assemble in front of the Flag Pole.

Annual Fire Drill

In compliance with its Environmental Management Plan, the Metals Industry Research and Development Center held its annual Fire Drill last March 21, 2017. Adjunct to this activity was the conduct of the Fire Fighting Seminar by FO2 Hover L. Verosil of the Bureau of Fire Protection through the assistance of Urduja Security Agency. Participants from the EMS Fire Bigade, PWS, MIAP, COA, Canteen Concessionaire, Janitorial and Security services attended the lecture and demonstration on fire figthing.

Above:
FO2 Hover L. Verosil demonstrates the use of Fire Extinguisher.

Below:
Class 2017 of the MIRDC Fire Fighting Seminar.

Engr. Emerito Banal tests his Fire Fighting skill.

Renzie Jabson together with Yolanda Sumagui of COA and Engr. Fernando Opeda of PWS during the Fire Drill Mobilization.

OED during the head count with Engr. Robert O. Dizon and Dr. Agustin M. Fudolig.

2017 Women's Month Celebration

On March 10, 2017, MIRDC deployed 20 personnel to participate in the 2017 DOST Women's Month Celebration with the theme "We Make Change Work for Women." The event was opened by Dr. Elizabeth A. Fontanilla, DOST-Wide GAD Focal Person, with a heart-warming message. One of the major highlights of the celebration was the Forum on Women Are Game Changers led by three renowned resource persons from the public and private sectors and the academe.

Attending on behalf of the Hon. Mayor of Taguig City, Hon. Laarni L. Cayetano, was Atty. Maria Del Carmen Beatris L. Sarmiento, Councilor of Taguig who candidly shared her own experiences as a woman in public service in line with the topic on Women as Game Changers. Her 15-minute talk only served as a teaser as she proceeded to deliver the Honorable Mayor's 3-page message that made the crowd laughingly realize that the speech is yet to begin. Dutifully, Atty. Sarmiento delivered the Mayor Cayetano's message that evolved around the successes of women as leaders in the public service.

In consideration of the participation of the male gender in the event, the topic on "Is Going Natural Safe for Women and Men: Herbal Medicine in the Philippines" was included in the forum that was presented by Dr. Gemiliano DL. Aligui, Vice President UERMMC, an academician and also a former DOST official. The discussion focused on the difference between herbal medicine and food supplements wherein Dr. Aligui advised the crowd to check the label

GAD Activities

(L-R) Melissa V. Neri, Salvacion V. Ruiles, Jocelyn R. Jerusalem, Ligaya M. Rubis and Marlene R. Rafanan during the Forum on Women as Game Changers held at the DOST Executive Lounge last March 10, 2017.

Checking out Slimmer's World Body Fat Analyzer are Florale G. Gamo and Ligaya M. Rubis with Engr. Jayson P. Rogelio at the DOST Executive Lounge.

Confidently joining the group of ZUMBA advocates were Norma B. Garcia and Rebecca C. Jabson during the Zumba session held at the DOST Executive Lounge.

for its component and origin as precautionary measure.

The last topic on "Becoming a Successful Woman Entrepreneur" was presented by Ms. Maura D. De Leon, CEO of Glorious Industrial and Development Corporation, manufacturer of the Stevia food supplement. Ms. De Leon, who is commonly called as "Mau" by friends and colleagues, started her speech with a confession that she is not comfortable in speaking in front of a large crowd. However, she was able to naturally deliver her speech focusing on how she became successful in business inspite of several pitfalls in her life. Ms. Mau easily warmed the crowd due to her openness in confessing her her mistakes due to naivety in the corporate world and her determination to succeed for the benefit of her family.

The forum ended with Dr. Teodoro M. Gatchalian, DOST Asst. Secretary for Administration, delivering the closing remarks.

MIRDC 2017 Employee Gatherings

A Pirate's Voyage

One of the most awaited personnel welfare activities was the MIRDC Teambuilding themed as "MIRDC Pirates Voyage to Alahbiga." On May 11, 2017, FAD-AGSS again scouted a venue that is secluded in the outskirts of San Juan, Batangas - the Alahbiga Beach Resort. The program of activities was facilitated by the very comic tandem of MIRDC's promising hosts, Engrs. Arvin Yan V. Pacia, Karl

Top bosses perform a surprise dance number.

MIRDC's Deputy Directors candidly participate in the post-it game entitled "Idikit Mo sa P at T ko."

Some of the happy faces during the celebration (Simplicio Morla, Serafin Garcia and Augusto Atanacio of PD).

MIRDC's Wacky Hosts in their "most behaved mode" as they receive their Certificate of Appreciation for successfully facilitating the Program.

Grand Prize Winner of "Idol Ko, Pirated Ko" Division Presentation Contest. "Birit Pa More Adele."

Andrew S. Chavez and James Asher B. Cabarloc, who captured the crowd's interest through their jokes and by soliciting audience participation.

Surprise numbers from the Top Management, fun group games and division presentations graced the whole day celebration. Presentation of the "Idol Ko, Pirated Ko" celebrity impersonation contest bonded the crowd together in anticipation as to "who will turn-up as who" on stage. Evidently, it was the Analysis and Testing Division's Mary Joy Revilla-Baroña as "Adele" who bagged the Grand Prize by keeping the judges and audience in awe during her rendition of the song "All I Ask".

Starting Anew

As part of MIRDC's 51st Anniversary Celebration, FAD-AGSS facilitated the conduct of the Employees Day last June 23, 2017. Themed "Starting Anew: Shining Brighter Beyond 50," all employees attended the activity donned in their Filipiniana costumes. To complete the event, a Folk Dance Revolution 2017 Contest among the divisions was orchestrated, with the particpating personnel presenting their rendition of the Filipino Folk Dance in a Hip-Hop and latest dance tune. Once again, FAD ranked 1st in their rendition of Tinikling in the upbeat tune of WORTH IT.

It's Fun @ MIRDC

Pandanggo sa Ilaw by OED & PMD

Singkil by MPRD

Tinikling by FAD

Subli by PD

Bulaklakan by ATD

Maglalatik by TDD

Divisions @ a Glance

MIRDC

The MIRDC Family

YOUNG@HEART

After a year of working towards the attainment of our Division's goals, the best way to celebrate our accomplishments was through the end of the year get together. Last December 14, 2017, MIRDC held its Thanksgiving Celebration at the newly constructed Titanium Auditorium with the theme "Young @ Heart."

This time, everyone was enjoined to be in their comfortable and colorful kid-like attire. Different flavors of ice cream, chocolates & mallows, Stick-O's and assorted candies adorned the yeatly event, bringing out the kid in us in a relaxed and worry-free atmosphere. Added to this was the cute children carollers of the DOST DAY CARE who also joyfully danced the Baby Shark song for the finale.


Boss Mercy with PMD Carollers


Ma'am Oya with her FAD Carollers


MPRD Jammin' with the Executive Director


PD youngsters performing a dance number


ATD Gents


TDD Ladies and Gents

A visit from the DOST Daycare

Wishing MIRDC a Merry Christmas and delighting the crowd with their Baby Shark dance moves.

Awards and Recognitions

Recogniton of MIRDC personnel's outstanding performance and achievements is celebrated twice a year, during the mid-year MIRDC Anniversary Employees Day and the year-end Thanksgiving Celebration. Below are the list of awardees for CY 2017.

LOYALTY AWARD	Name of Awardees	Division
Fifteen (15) Years	Jelly N. Ortiz (1/1/17)	FAD
Twenty (20) Years	Arlene G. Estacio (09/23/17)	ATD
Twenty Five (25) Years	Florentino J. Lafuente (3/17/17)	MPRD
	Simplicio N. Morla, Jr. (3/25/17)	PD
	Fred P. Liza (4/21/17)	PD
	Felipe G. Pachoco (4/28/17)	TDD
	Joseph A. Romero (07/07/17)	MPRD
	Efren A. Andal (07/07/17)	PD
	Luis C. Forbes (7/07/17)	ATD
	Jocelyn R. Jerusalem (07/10/17)	MPRD
Thirty (30) Years	Maria Luisa A. Fajarda (3/17/17)	ATD
	Lito I. Dimaculangan (3/17/17)	ATD
	Bobby F. Fronda (3/17/17)	PD
	Manuel F. Ascaño (08/04/17)	PD
	Amado D. Tagal, Jr. (08/18/17)	PD
	Ma. Gladys F. Gargollo (09/22/17)	FAD
	Marlyn U. Ramones (09/22/17)	TDD
	Teresita C. Villoso (10/09/17)	TDD
	Camilo C. Cariaga (11/17/17)	PD
	Noel R. Datul (11/17/17)	PD
	Roy C. Sagrado (11/27/17)	TDD
	Minda B. Bardiano (12/08/17)	FAD
	Rodnel O. Tamayo (12/08/17)	MPRD
Forty (40) Years	Augusto S. Atanacio, Jr. (4/2/17)	PD
	Marlito A. Gonzales (08/24/17)	FAD
	Josephine R. Esguerra (10/19/17)	TDD
PERFORMANCE EXCELLENCE	**Name of Awardees**	**Division**
For Year 2016	Rommel G. Adame	PD
	Ronie S. Alamon	PD
	Christian D. Brual	PD
	Laureano L. Dalay	PD
	Allan John S. Limson	PD
	Virgilio H. Macanip	PD
	Francisco M. Marasigan	PD
	Jayson P. Rogelio	PD
	Reynaldo L. Dela Cruz, Jr.	TDD
	Alma C. Dupagan	TDD
	Kristine A. Gealan	TDD
	Jerameel C. Falcatan	ATD
4 Consecutive years (2013-2016)	Ronaldo L. Agustin	TDD
5 Consecutive years (2012-2016)	Reynaldo M. Loreto, Jr.	TDD

Graduate Studies	**Name of Awardees**	**Division**
Bachelor of Science in Electrical Engineering	Joel A. Eligue	ATD
Bachelor of Technology Major in Tool & Die Engineering	Rommel G. Adame	PD
Master of Science in Mechanical Engineering Major in Energy Engineering	Florante A. Catalan	ATD
Licensure Exam (RA 1080)	**Name of Awardees**	**Division**
Chemical Technician	Jerameel C. Falcatan	ATD
LET for secondary level	Anthony Greg F. Alonzo	PMD
Division Model Employee	**Name of Awardees**	**Division**
Level I	Jerameel C. Falcatan	ATD
	Juanito G. Mallari	MPRD
	Francisco M. Marasigan	PD
	Melanie T. Valencia	PMD
	Reynaldo M. Loreto, Jr.	TDD
Level II	Arvin Yan V. Pacia	ATD
	Zalda R. Gayahan	TDD
	Rea C. Castro	PMD
	Pablo Q. Acuin	MPRD
	Ronie S. Alamon	PD
	Ariane Mae M. Villanueva	FAD
MIRDC Model Employee	**Name of Awardees**	**Division**
Level I	Reynaldo M. Loreto, Jr.	TDD
Level II	Zalda R. Gayahan	TDD
Best Organizational Unit	Library and Technology Promotion Unit (TIPS-LTPU)	TDD
CORE VALUES	**Name of Awardees**	**Division**
Professionalism	Jerameel C. Falcatan	ATD
Responsiveness	Marlene R. Rafanan	FAD
Integrity	Reynaldo O. Bayot	FAD
Dynamism	Hazel Marie T. Murcilla	PMD
Excellence	Rosario D. Sancon	FAD

MIRDC is proud of its valued human capital who are the torchbearers and advocates of exemplary performance.

Financial Resource Management and Performance in 2017

After celebrating its 50th Founding Anniversary, the Metals Industry Research and Development Center (MIRDC) conquered another year as it continue its journey towards the realization of its vision embodied in the MIRDC Strategic Plan 2015-2025. The Agency envisioned itself to be the Center of Excellence in science, technology and innovation for a globally-competitive metal, engineering and allied industries by 2025. A vision which finds anchor to the 10-Point Socio-Economic Agenda of the present administration of promoting science, technology, and the creative arts to enhance innovation and creative capacity toward self-sustaining, inclusive development.

In 2017, the agency, together with its collaborators, funded and implemented several research and development (R&D) projects which could be viewed as vital to our country's aspiration of rapid and inclusive economic growth. The MIRDC continued to implement banner projects on mass transportation that aim to improve mobility and decongest the highly clogged main thoroughfares of the metropolis.

MIRDC engaged in various S&T activities including designs to develop commercial models of proto-types and determine most suitable resources for iron making. It participated in promotional activities; likewise, the Center funded training programs for the development of its human resources.

In spite of its huge financial requirement, MIRDC maintained fiscal sufficiency towards the end of its operating year.

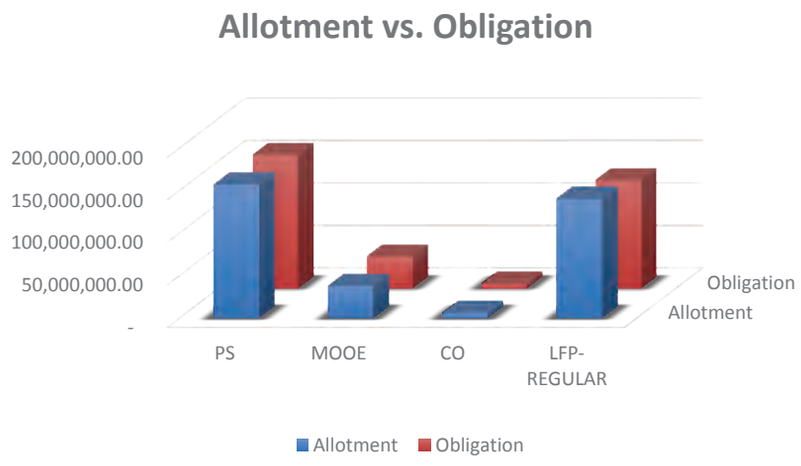


Figure 1. 2017 Allotment Received vs. Obligation

Regular Fund: Source and Utilization

Allotment and Obligation

In 2017, the Metals Industry Research and Development Center (MIRDC) has a total approved budget of P344,597,382.15. Of which, 329,489,576.00 (95.62%) was for current year's appropriation and P15,107,806.15 (4.38%) was for locally funded projects (LFP) accounted for in prior year. Under the current appropriation, 47.93% or 157,927,646 (inclusive of RLIP) was allotted for Personnel Services, 11.72% or P38,613,930.00 for MOOE, 2% or P6,632,000.00 for Capital Outlay and 38.34% or P126,316,000.00 for Locally Funded Projects-Regular.

The locally funded projects-regular for 2017 has two (2) major distributions, namely: Repair of Facilities and Disaggregated Grant-in-Aid (DGIA) Projects. The repair of facilities shared 47.90% or P60.5M of the LFP, while, DGIA projects shared 52.13% or P65.82M of the fund.

When added to the 2016 LFP, the approved budget for repair of facilities would total to P62.99M and DGIA projects would amount to P78.44M.

Of the total allotment, the Center obligated P331,064,856.49 or posted 96.07% performance. Please refer to Fig. 1 for details.

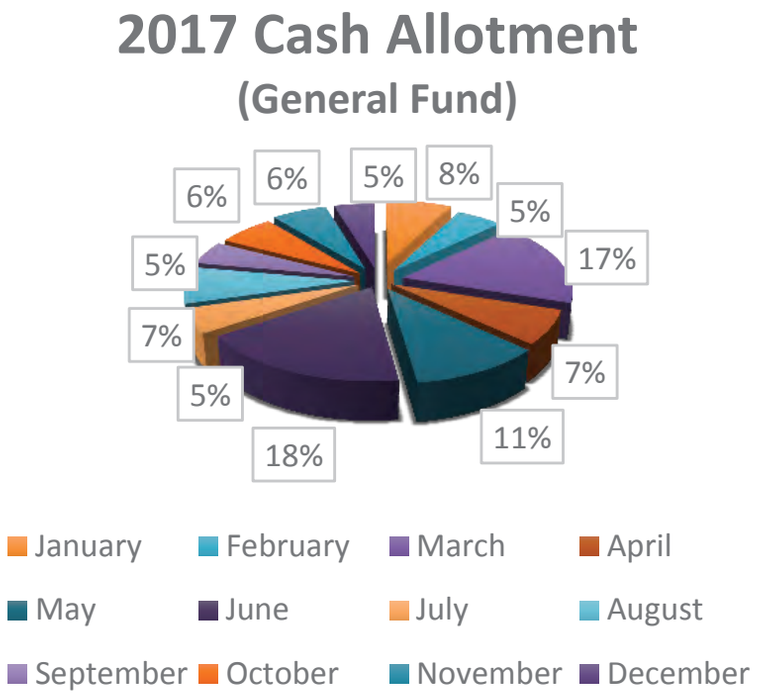


Figure 2. 2017 Cash Allotment Received

Cash Allocation and Utilization

The cash requirement related to the 2017 budget was originally drawn in accordance with the agency's Physical Work Plan and in compliance with the provisions of DBM's National Budget Circular (NBC) Letter No. 2016-9 dated 10.27.16 and the accounts payable identified as of date of preparation. The total cash allocation released by the Department of Budget and Management was P412.5M. Details of monthly releases are shown in Figure 2.

As can be gleaned in Figure 2, March has the biggest allocation with18% share in the distribution and February, September and December have the lowest with 5% only.

As of year-end, the agency posted 66% utilization rate on its regular and specific budget.

Trust Receipts: Source and Utilization

MIRDC gained prominence in building prototypes that draw attention due to its unique and innovative concepts. The agency has undergone collaborative projects with other agencies. The center received a total amount of P19.9M freshly infused by its partner-agencies and contracting entities in 2017. This amount represents funding support to manage programs and projects, develop models, fabricate parts and build equipment. It also includes additional funding support for the continuity of existing programs and projects. All amount collected were deposited to the Bureau of Treasury (BOT) and subsequently requested for release. Details of Fund Transfers are shown in Table 2.

The total amount released by DBM was P92.15M to cover expenditures of programs and projects to be undertaken by the Center. The amount was inclusive of reverted cash balance of Trust MDS Account as of EOY2016 and cash refunds for customers' deposits and performance bonds.

The Center disbursed P56.16M or 61% of the total cash allocation.

Table 2. Schedule of Fund Transfers from Funding Agencies & Contracting Entities in 2017

Funding Agency	Description	Amount
PROGRAMS & PROJECTS WITH FUND BALANCES CARRIED IN 2017		
CARE PHILS.	*Design Modification of Tikog Flattening Machine*	588,831.00
CLSU	*Design and Development of Forage-Blades and Chopper for Goat Production*	188,174.38
DFA	*Prototyping and Pilot Production of Eyelet Riveter/Machine*	128,262.13
DOST	*Development of 12HP Single Cylinder Diesel Engine*	2,655,900.76
DOST	*Development of a Tent System for Emergency Application*	87,061.23
DOST	*Development of Prototype Trainset*	38,056.00
DOST	*Establishment of a Gear Making and Assembly Facility*	21,702,630.01
DOST	*Human Resource Intervention for Sustainable Growth and Competitiveness of the M&E Sector: Development and Implementation of Appropriate Training Curriculum Design for CNC Machine Tool Programming and Operations*	78,521.65
DOST	*Roll-out of DOST-Developed Food Processing Equipment to the Regions*	16,810,296.37
DOST	*Setting-up of a One Stop Laboratory Services for Global Competitiveness (Onelab)*	320,287.77
DOST	*Strengthening S&T Capabilities Through Competency-Based Human Resource Management for Department of Science and Technology*	758,871.52
DOST	*Strengthening the Project Management and Engineering Design Services at DOST*	795,058.75
DOST	*Study on the Viability of Deploying DOST-developed Mass Transportation Technologies in Baguio City and La Trinidad*	99,836.00
DOST	*Technology Promotion of Road Train in Metro Manila and Pampanga*	349,214.00
DOST 7	*Technology Promotion and Field Testing of the Hybrid Electric Road Train in Cebu City*	2,407,588.40
DTI	*Supporting Philippine companies in the Preparation and Implementation of an Aerospace Quality Management System (AQMS) Aligned with AS9100 Requirements*	8,390,451.00
DTI-BOI	*Enhancing Tool and Die Industry Competitiveness by Expanding the Pool of Trained and Highly Skilled Die and Mold Designers and Makers (D2M2 Project)*	2,024,383.84
PCAARRD	*Design and Development of Sugarcane Harvesting Equipment for Small Sugarcane Farms*	1,801,261.98
PCAARRD	*Design and Development of Superheated Steam Treatment System for Stabilized Brown Rice*	481,023.72
PCAARRD	*Development of a Fluidized Bed Dryer for Production of Stabilized Brown Rice (SBR)*	3,320,351.10
PCAARRD	*Piloting of the Hand Tractor Attached Transplanter and Hand Tractor Attached Harvester in Selected Rice Growing Regions*	1,447,755.45
PCAARRD	*Retrofitting of Compact Rice Mill for Stabilized Brown Rice*	54,963.50
PCIEERD	*Design and Optimization of Austenitic Manganese Steel Liner for Philippine Aggregates and Mineral Processing*	1,695,933.91
PCIEERD	*Development of Prototype Trainset*	1,150,843.78
PCIEERD	*Modification of Road Train Energy Storage Using Lithium Ion Batteries*	26,799.86
PCIEERD	*Performance Testing of a Five-Coach Centrally Powered Electric Hybrid Road Train for Local Application Phase II*	293,704.17
PCIEERD	*Simulation and Evaluation of AGT System Passenger Stations-Phase II*	1,669.91
PCIEERD	*Test and Evaluation of 120-Passenger per Coach Capacity Automated Guide-way Transit System*	525,177.88
	Sub-total	**68,222,910.07**

Table 2. Con't.

Funding Agency	Description	Amount
PROGRAMS & PROJECTS WITH FUND TRANSFERS IN 2017		
ANAKI SYSTEMS SALES	*Design and Development of Techmetry Module Casing Mold Sets and Rapid Phototyping of Chopper Control Electronic Rack for the Localization of LRT 1 Maintenance Parts and Components*	216,317.00
DOST	*Enhancing OneLab for Global Competitiveness - RDIs Component-MIRDC*	1,033,538.00
DOST	*MIRDC Participation to the Celebration of 2017 National Science and Technology Week (NSTW)*	917,800.00
DOST	*Training/Workshop on Scientific Writing for DOST Researchers*	153,000.00
DOST	*Leveraging R&D Human Resource through HR Analytics*	163,000.00
DOST-NCR	*Establishment of Complementary Baby Food Plant*	435,375.00
DTI	*Development of Ceramics Equipment*	408,400.00
DTI-BOI	*Technical Economic Feasibility Study to Determine the Most Suitable Ironmaking Technology for Value Adding of Phil. Magnetite Resources*	4,750,000.00
PCAARRD	*Pre-Commercialization Services of Rice Transplanter Attachment (RTA) and Rice Harvester Attachment (RHA) for Hand Tractor*	1,453,858.00
PCIEERD	*Design and Optimization of Austenitic Manganese Steel Liner for Philippine Aggregates and Mineral Processing*	1,208,631.00
PCIEERD	*Modification of Road Train Energy Storage Using Lithium Ion Batteries*	3,956,711.00
PCIEERD	*Technical Economic Feasibility Study to Determine the Most Suitable Ironmaking Technology for Value Adding of Phil. Magnetite Resources*	4,750,000.00
R.U. FOUNDRY AND MACHINE SHOP CORP.	*Design and Development of a Sugarcane Juicer for Community Based Organic Muscovado Production*	115,566.00
TAPI	*Fabrication and Installation of Exhibit Materials for the 2017 National Science and Technology Week (NSTW)*	200,000.00
TAPI	*Fabrication of a Miniature Model of the Prototype Hybrid Electric Train (HET)*	165,000.00
	Sub-total	**19,927,196.00**
	Grand-total	**88,150,106.07**

Source: MIRDC-FAD FMS-Accounting Unit

Revenue Generated

MIRDC served the requirements of various companies and other government entities, particularly in the fabrication of metal components, calibration, analysis, and endurance testing. The Center also provided specialized skills training to individuals in the area of metals and engineering.

Out of these economic activities, the agency generated revenues that were subsequently deposited to the National Treasury.

The total amount collected as revenues from various sources during the year was P27.5M. The detail of distributions is shown in Table 3.

For the generated revenues, the Analysis and Testing Division (ATD) was the top grosser with revenue earnings of P20.5M, followed by the Technology Diffusion Division (TDD) with P3.5M, Materials and Process Research Division (MPRD) with P1.5M and Prototyping Division (PD) with P1.3M.

Table 3. Distribution of Revenue Generated From Operation

Description	Amount
Fines and Penalties	459,391.95
Other Service Income	23,429,389.56
Seminar / Training Fees	3,467,840.00
Interest Income	5,083.85
Rent/Lease Income	150,296.61
Other Business Income	8,100.50
Total	**27,520,102.47**

Source: MIRDC-FAD FMS-Accounting Unit

PLANNING and MANAGEMENT

Individual accomplishments of various units, sections, and divisions are valuable contributions that determine the Center's significance to the growth and advancement of the M&E and allied industries. Thoughtful planning, along with effective management, underpin the Center's success in achieving its goal of molding the future of the metals industry.

In 2017, the Planning and Management Division gave a superb performance that helped the DOST-MIRDC determine strategies necessary to appropriately meet the demands of the M&E and allied industries.

Revisiting the MIRDC Strategic Plan: Setting the Center's Direction for 2018-2025

The implementation of the MIRDC Strategic Plan 2015-2025 took effect in November 2015 and is currently being updated in conformance with the national agenda. It is the blueprint of the Center's course of action in addressing priority issues and maximizing gains for the metals industry to keep abreast with changes in the economic and business environment and remain as the industries' competent and dependable partner. Likewise, the initiatives identified in the Plan serve as the key requirements in attaining the Center's vision which is to be a "Center of excellence in science, technology and innovation for a globally-competitive metals, engineering and allied industries by 2025."

In 2017, President Rodrigo Roa Duterte presented his 10-point Socio-Economic Agenda pushing the Department of Science and Technology to align its policies with the said Agenda and to revisit the Harmonized National Research and Development Agenda (HNRDA) 2013-2020 and to formulate the DOST Plan 2017-2022. As one of the attached agencies of the DOST, the MIRDC saw the need to revise its Strategic Plan to anchor the Center's plans and programs with the new priorities administration.

The review process was done through a three-day Strategic Planning Workshop conducted on 10-12 April 2017 in Laguna. It was organized by the Finance and Administrative Division (FAD) in collaboration with the Planning and Management Division (PMD). The management team reviewed the Center's vision,

MIRDC management team during the Strategic Planning Workshop conducted on 10-12 April 2017 at Rockpoint Hotspring Resort in Pansol, Calamba, Laguna.

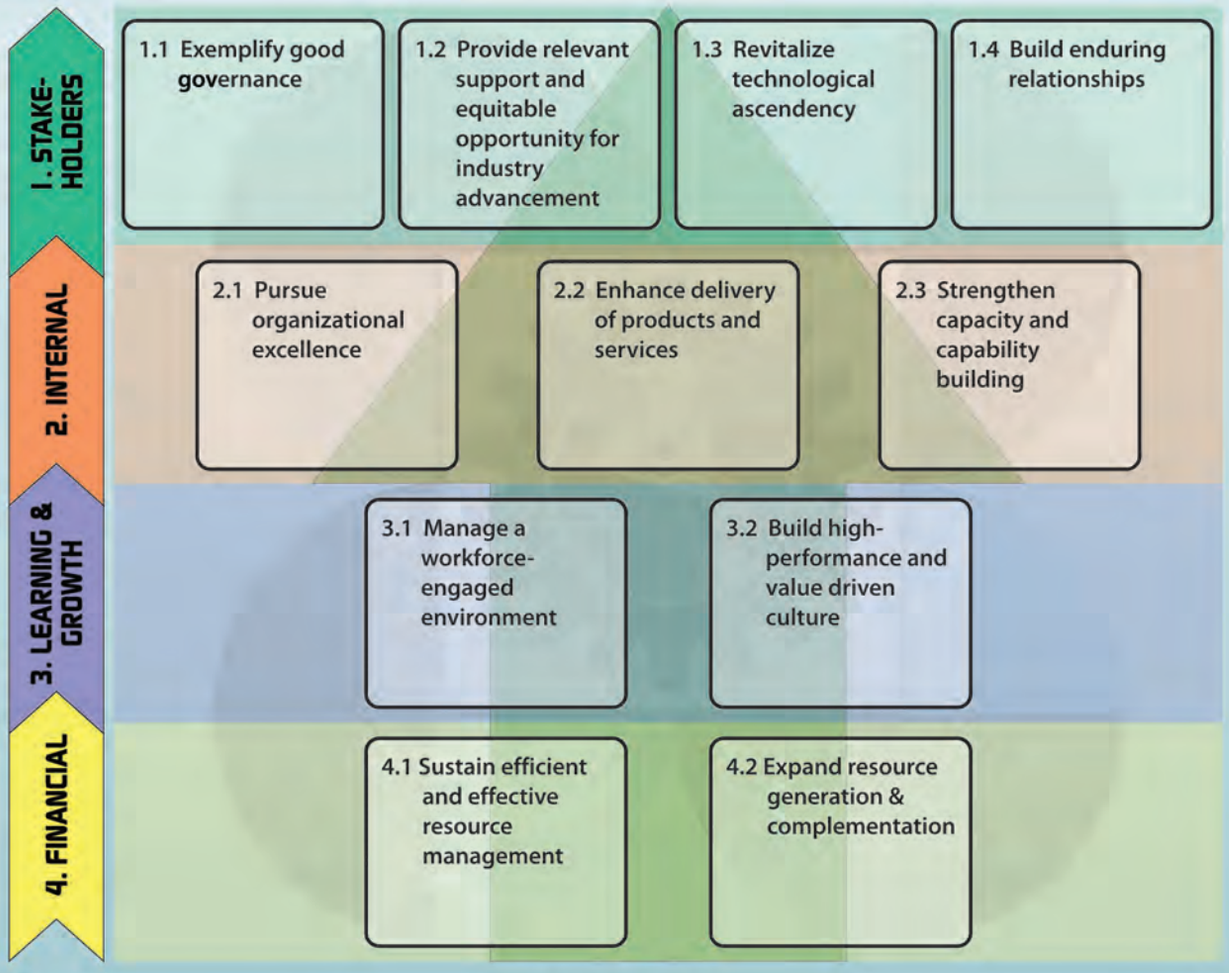
mission, strategic objectives and core values. The Center's strategic advantages (strengths and opportunities) and strategic challenges (significant risks and threats) were assessed. All factors affecting the agency in executing its current strategies were identified. Its strengths and weaknesses as an organization were validated; the opportunities and threats using PESTEL (Political, Economical, Social, Technological, Environmental and Legal) helped the agency assess the external factors that can affect its operation.

The management team employsed the Balanced Scorecard (BSC) approach as the performance management framework during the planning process. A strategy map was developed to be on track towards the fulfillment of its vision through science and technology initiatives particularly in uplifting the metals and engineering industry. Eleven (11) new strategic objectives were formulated categorized under the four thematic perspectives, as shown in the figure 1.

MIRDC STRATEGY MAP 2018-2025

VISION

Center of excellence in science, technology and innovation for globally competitive metals, engineering & allied industries by 2025.



MISSION

To provide both government and private sectors in the metals, engineering and allied industries with professional management and technical expertise on the training of engineers & technicians; information exchange; quality control & testing; research & development; technology transfer; and business economics advisory services.

CORE VALUES

Professionalism.
We adhere to the highest ethical standards of performance.
We value our work and are committed to perform to the best of our ability.

Responsiveness.
We spearhead implementation of projects that address the needs of the metals and engineering industries.
We find solutions to real-life problems through science, technology and innovation.

Integrity.
We act responsibly, work honestly, and encourage transparency.

Dynamism.
We perform our jobs with vigor and enthusiasm.
We welcome change as an opportunity for growth and continual improvement.

Excellence.
We adhere to world-class performance and continuous improvement in all we do.
We always do our best in every task/endeavor.

Since change is inevitable, MIRDC as an organization always welcome change and actively pursues innovations. The Center is consistent in attaining its goals and partnering with industry to attain its strategic direction forced on industry competitiveness and empowerment. The Center's deliverables are always the results of hard work, dedication and commitment, which are the potent avenue in maintaining its capability as the sole government agency sustaining the growth and advancement of the metals and engineering industry in the Philippines.

Implementation of Quality Management System for Aerospace Industry

The Philippine aerospace industry is steadily growing and seen to post high revenues in the next 10 years. It is considered to have a strong potential and to transform into a lucrative investment for Philippine metal companies.

During the first quarter of the year, MIRDC initiated the implementation of the Quality Management System for the aerospace industry to enhance the competitiveness of local aerospace companies through capability development. Major aerospace manufacturers and suppliers worldwide have acquired AS9100 certification of its quality management system.

The project entitled "Supporting Philippine Companies in the Preparation and Implementation of an Aerospace Quality Management System (AQMS) aligned with AS9100 Requirements" is co-implemented by the Planning and Management Division (PMD) and the Technology Diffusion Division (TDD). It aims to enhance the competitiveness of the Philippine aerospace sector by supporting selected companies in the preparation and implementation of an aerospace quality management system (AQMS) leading to AS9100 certification. Major activities include training and consultancy services to beneficiary companies.

Commitment Signing of Beneficiary Companies and AS9100 Executive Overview for CEOs held last Jan 23, 2017 at the Acacia Hotel Manila in Alabang, Muntinlupa City.

The following activities were accomplished in CY2017:

- Completion of four (4) training programs;
- Conduct of benchmarking activities to five (5) AS9100 certified local companies and six (6) beneficiary companies;
- Participation to the Business to Business (B2B) activities in Aeromart Nagoya held last September 26-28, 2017; and
- Conduct of bidding for consultancy services on the AS9100:2015 or Revision D standard.

A request for project extension has been forwarded to the DTI-BOI to enable the project team to implement activities lined up in CY 2018.

MIRDC will continue to collaborate with the Aerospace Industries Association of the Philippines (AIAP) to help the industry further improve on its capability. The growth of the Philippine aerospace industry shall help local metals and engineering (M&E) companies to move up the value chain thereby providing quality jobs for Filipino engineers and technicians and contributing towards manufacturing resurgence in the country.

Intensifying Operational Excellence through ICT

Nowadays, information and communication technology (ICT) plays a vital role in the success of an organization. In many instances, efficiency of operations is achieved through ICT substantially contributing for the realization of the set goals and objectives of the company.

Recognizing the importance and benefits of the ICT, the MIRDC top identified the implementation of ISO 27001 as one of its key priority programs in order to establish and strengthen its information security management.

Under the project entitled "Establishment and Strengthening of Information and Communication Technology (ICT) Infrastructure (ICT INFRA) and Business Online Solution System (BOSS) of the Center in Support to the Productivity and Competitiveness of the M&E Industries," the Center is looking forward to the implementation of an Information Security Management System (ISMS) to ensure the proper managing and safeguarding of information assets related to finance, intellectual property, data on employees and customers, among others. This is to keep the Center's information assets secured and complement the requirements of RA 10173 or the Data Privacy Act of 2012 the implementation of which is spearheaded by the National Privacy Commission (NPC) of the Philippines.

During the third quarter of the year, seminar/training on awareness and documentation of ISMS was conducted in preparation for the planned alignment by 2018 of the Center to ISO 27001:2013. Concerned division and section chiefs and staff members of the Management Information Services (MIS) participated in the said activity.

Participants during the ISMS Seminar conducted on August 29-31, 2017.

Other major accomplishments under the project include the following:

- Improved LAN interconnection.
  Installed temporary connection for ATD-DHO, TSS, COA, Metrology, ATD-CLS, FAD GMU. Firewall was set-up for network security, monitoring and anti-hacking and Access Point for wireless internet connection.

- Enhanced/Developed Information Systems

  ➢ PhilMet Website

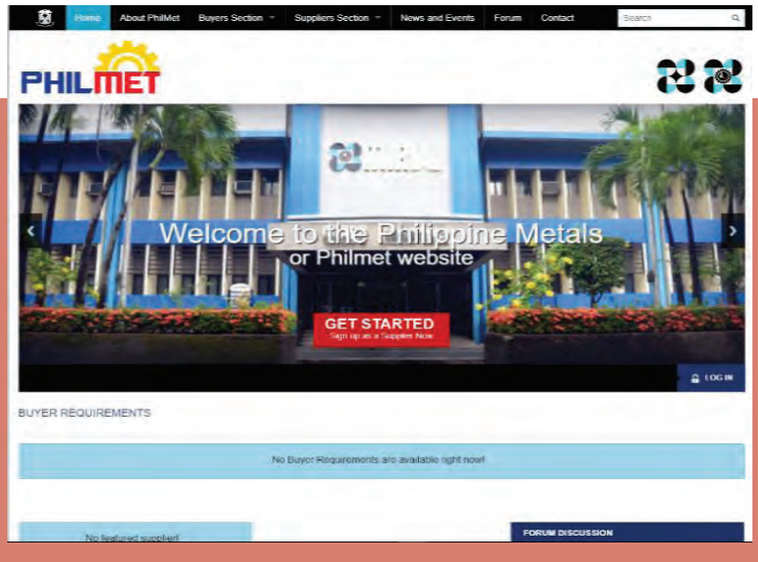
  The main objective of the Philippine metalworking website or PhilMet is to help the local metals and engineering firms showcase their products and services thru on-line services.
  The PhilMet website was created with the following objectives: a) to create official directory of Philippine metal industry and other related providers; b) to provide the capability of M&E industry in the Philippines for exportation/service outsourcing to prospective clients in other countries, and c) To accommodate business discussions/transactions using the website. By the end of 2017, 39 suppliers and eight (8) buyers registered with PhilMet.

  ➢ Purchase and Inventory Management System (PIMS)

  The PIMS is the integration of the existing Purchase Request (PR) Modules such as Request for Quotation (RFQ), Abstract of Canvass (AOC), Purchase Order (PO) and Property/Inventory system. It is a web-based system that is compatible with both desktop and mobile application. The features include: monitoring of purchase request from creation, canvass, order and delivery; asset tracking thru the integrated inventory system; asset identification thru the acknowledgement receipt of equipment (ARE); inventory optimization (reorder point, list of stocks etc.) and disposal processes.
  PIMS has reporting features that would generate the status of the purchase request, the abstract of canvass, purchase order, inventory of equipment and the acknowledgement receipt of equipment.

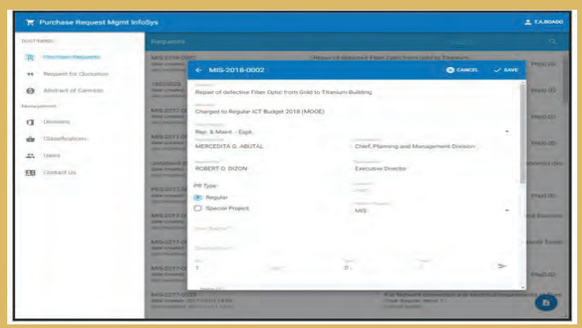
  ➢ **S**ingle Sign On (SSO)

  An authentication process that allows a user to access multiple applications with one set of login credentials. SSO is a common procedure in enterprises, where a client accesses multiple resources.

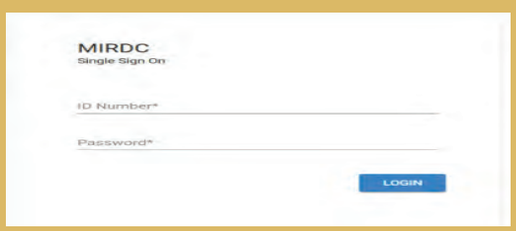


PhilMet Website

The SSO system authenticates and verifies the profile of MIRDC employee thru its personal data sheet (PDS) and by getting information from employee database. The system is similar with the unified identification system whereby the uses a single login account to access different information systems or modules within the MIRDC internal information systems. SSO will generate PDS and reports, such as the total number of employees, employees according to gender, age, educational background, years of service and other related information. It will also log the user login, which is important in doing systems security audit.



A screenshot of the Purchase and Inventory Management System (PIMS).



A screenshot of the Single Sign-On (SSO).

- Acquired ICT equipment

  Under the ICT project, a total of 32 new computer units (i.e, 13 laptops and 19 desktops) were acquired and distributed to all the divisions.

- Participation to IT Summit

  On December 13, 2017, the MIRDC participated in the Symposium and Poster Exhibit of IT Solutions Developed by DOST which was conducted at the NAST Audio-Visual Room (AVR), 2/F Science Heritage Building, Bicutan, Taguig City. It was also participated by all the agencies of DOST aiming to showcase all the systems being developed. The said activity opened a door for future collaboration through the adoption of the systems created that are suitable to the needs of the agency.

MIRDC's ICT infrastructure and information systems are stronger, more accessible and well secured through this project. More improvements are expected as the Center continues to implement the Information Systems Strategic Plan (ISSP) under the MITHI program and equip the Center in the advent of Industry 4.0.

Symposium and Poster Exhibit of IT Solutions Developed by the DOST.

the management

From left: **Ms. Aurea T. Motas** (Chief, Finance and Administrative Division), **Ms. Mercedita G. Abutal** (Chief, Planning and Management Division), **Atty. Trixie Hazel C. Veluz** (Attorney IV), **Dr. Rio S. Pagtalunan** (Chief, Analysis and Testing Division), **Dr. Agustin M. Fudolig** (Deputy Executive Director for Technical Services), **Engr. Robert O. Dizon** (Executive Director, MIRDC), **Engr. Jonathan Q. Puerto** (Deputy Executive Director for Research and Development), **Dr. Danilo N. Pilar** (Chief, Technology Diffusion Division), **Engr. Rodnel O. Tamayo** (Chief, Materials and Process Research Division), **Engr. Fred P. Liza** (Chief, Prototyping Division)

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DTI - Board of Investments

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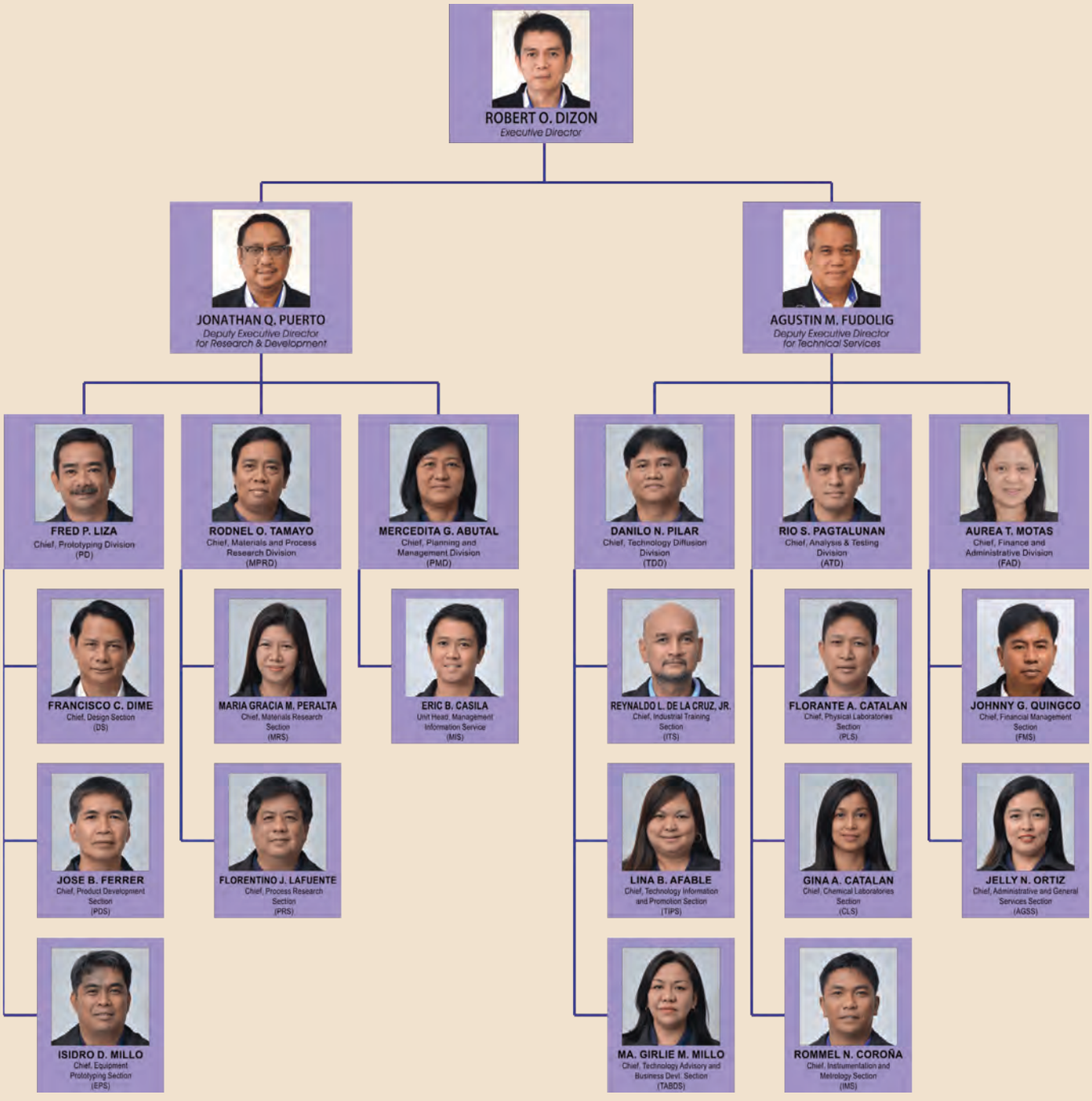
Council Secretary/Legal Counsel

MIRDC ORGANIZATIONAL STRUCTURE



office of the executive director

prototyping division

materials & process research division

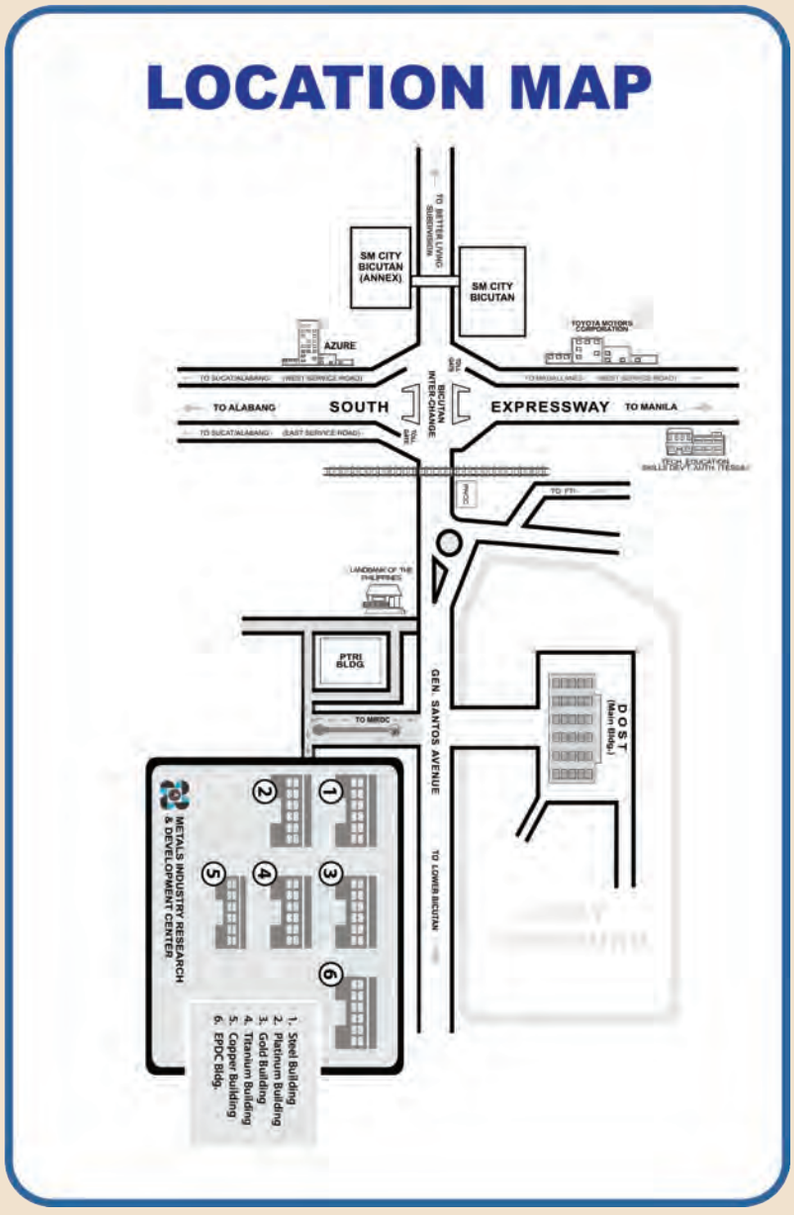
planning & management division

analysis & testing division

technology diffusion division

finance & administrative division

LOCATION MAP & EXTENSION OFFICES



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(088) 858-3933 (Technical)
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MIRDC HYMN

Kaya Ko, Kaya Mo, Kaya Nating Lahat

Tungkulin mo't tungkulin ko
Paglingkuran lahat kayo
Buong husay, buong ingat
Sa lahat ng oras
Gamit ang Agham at Teknolohiya
Patuloy na manaliksik pa
Handog twina, bagong kaalaman
Industriyang metal mapayaman
Kung kaya ko, ay kaya mo
At kaya nating lahat
Lahat ng bagay na mabigat
Kung sama-sama'y mababuhat
Ang pag-unlad matutupad
Kung matapat ang gaganap
Ikaw, ako, tayong lahat
Isusulong ang bukas

Koro 1
Kaya ko, kaya mo, kaya nating lahat
Industriya ay tutulungan, pribado o gobyerno man
MIRDC ang Sentro na magbubuklod nito
Ang tagumpay makakamit kung sama-sama tayo
Instrumental
Tungkulin ay gagampanan, kakayahan ilalaan
Tayo ay maglilingkod nang buong katapatan
Gagawin nang mabilis, lahat sa tamang paraan
At ating mararating tagumpay na inaasam
(Ulitin ang Koro 1)
Koro 2 (a capella)
Kaya ko, kaya mo, kaya nating lahat
Ating baya'y tutulungan, marating ang pag-unlad
Tayo ay magtulungan upang ating marating
Ang pag-unlad kung sama-sama'y kaya natin
(Ulitin ang Koro 1 at instrumental)
Kaya ko, kaya mo, kaya nating lahat

editorial board

From left: Zalda R. Gayahan, Marlyn U. Ramones, Ma. Alicia B. Cabral, Franz Joseph O. Libao, Joey G. Pangilinan, Anthony Greg F. Alonzo, Danilo N. Pilar *(Editor-in-Chief),* Ronald L. Agustin, Lina B. Afable, Fred P. Liza, Marlene R. Rafanan (not in picture)

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