MIRDC 2015 ANNUAL REPORT

Accelerating Towards a Competitive Auto Parts Manufacturing Industries

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Message from the DOST Secretary

Congratulations to the Metals Industry Research and Development Center (MIRDC) for a successful 2015. Translating all scientific and technological initiatives into a reality for the benefit of the Filipinos is the very essence why the Department of Science and Technology (DOST) exists. Leading the nation toward technological self-reliance, we mean to spark in all Filipinos the belief that we have what it takes to face everyday challenges, we can do so by actively building our unique capabilities and harnessing creative problem-solving skills. Our purpose is to make science, technology, and innovation a way of life.

AT the MIRDC, visionary leadership coupled with competent R&D skills, availability of both technical and non-technical support, and the effort to nurture partnership with the industry are key factors that help create and sustain an environment that allows ideas to turn into useful realities. These ideas, taking the form of locally-developed technologies, are meant to instill among us, our industry partners and stakeholders the belief that synergized efforts are the best way to enhance our competitive advantage. I encourage the men and women of the MIRDC to build on these strong points to continue to give meaningful service to the M&E industries.

The MIRDC, through the programs and projects it implements, has consistently taken the lead to bring out a better and more empowered metals, engineering and allied industries. I am indeed grateful to have the MIRDC in the DOST family, for the determination to succeed and the significant contribution to nation building through intensified promotion of science, technology and innovation.

I urge you to remain focused, and be steadfast in reaching for excellence. With you steering the industry toward the path to success, the country's economic backbone is in good hands, Your unwavering determination to serve the metals, engineering and allied industries is a strong and solid basis for us to be optimistic about being a globally competitive Science Nation and benefitting from a robust economy in the years to come.

Mabuhay!

MARIO G. MONTEJO
Secretary, DOST
and Chairperson, MIRDC
Governing Council

Message from the OIC-MIRDC

The Department of Science and Technology envisions eight (8) major outcomes from all its S&T activities. Outcome 3 specifically spells out DOST's commitment to enable local industries to move up the value chain and attain global competitiveness through state-of-the-art facilities and capabilities. It is with great pride that I present to you the 2015 Annual Report of the Metals Industry Research and Development Center which manifests the Center's contribution to the fulfillment of this particular Outcome.

The 2015 Annual Report's theme, 'Accelerating Toward a Competitive Auto-parts Manufacturing Industry,' signifies the MIRDC's support to the achievement of the DOST's goals. Highlighted during this year are the Center's initiatives of establishing the Auto-parts Testing Facility, Heat Treatment Facility and the Gear Making and Assembly Facility – all of which involved the acquisition of state-of-the-art technologies. With the services that these facilities offer, local companies will be able to confidently manufacture products that are at par with our foreign counterparts. It goes without saying that with the establishment of these facilities and the acquisition of relevant technology, we are also continuously sharpening our manpower resources. Key personnel of the MIRDC were sent to attend local and foreign trainings and seminars. We are bent on widening our horizons, because we believe that with a strategic mix of technology and know-how, we can effectively strengthen the industry's traction as it steps up the value chain.

Encapsulated also in the Annual Report are the MIRDC's other activities equally significant to the realization of our goal to make local technologies work. The MIRDC carried on with the Advanced Transportation Systems Program which consists of the Automated Guideway Transit (AGT) System, the Hybrid Road Train, and the Hybrid Electric Train.

To add to these, our R&D teams were constantly engaged in projects in the field of disaster preparedness, food processing and agriculture industry empowerment, to name a few. Furthermore, metalworking and other related services were continuously offered to the industry. We have consistently been the industry's top choice where their needs for testing, training, and consultancy services are concerned. We also made sure that we do not only forge partnerships with the local M&E industries as we fostered foreign tie-ups as well.

The reason that the Center is able to do all of these is because we are guided by our Vision that is backed by a strong strategic support system. We are motivated by our desire to provide excellent services to the industry, who is not just our customer but our valuable ally. We share the same objectives. Together let us leverage our solid foundation, built on science, technology and innovation, for a globally competitive metals, engineering and allied industry.

ROBERT O. DIZON
Assistant Secretary, DOST
and Officer-in-Charge, MIRDC

VISION

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

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.

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.

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 to continually improve the effectiveness of our Quality and Environmental Management Systems at all times in order to meet customer satisfaction.

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, suppliers and the surrounding community.

To fulfill these commitments, we shall:

- Adopt new and appropriate technologies and processes to continually improve the quality of our products and services and our environmental performance;
- Implement programs to enhance the competency and awareness of all personnel;
- Promote quality and environmental awareness and health and safety practices in all levels of the Center;
- Comply with all applicable laws and regulations in the country including the requirements of DOST, customers, stakeholders, industry in which we subscribe to;
- Reduce dependence on the use of toxic and hazardous substances, including Ozone Depleting Substance (ODS);
- Implement an effective waste management and waste reduction program including where practicable, recycling and reusing of wastes; and
- Optimize the use of resources by continually identifying, implementing and reviewing practical measures to reduce resources usage.

Prototyping

Research and development activities of the Prototyping Division (PD) highlighted the Center's accomplishments in machine building and localization, agricultural mechanization, and S&T infrastructure establishment involving critical and strategic technologies and cutting-edge facilities particularly on advanced manufacturing technologies. As the country strives to achieve technological self-reliance, the DOST has invested heavily on the DOST-MIRDC on state-of-the-art facilities and capabilities intended to enable local industries to move up the value chain, increase productivity and attain global competitiveness.

The year 2015 saw the completion of the Die and Mold Solution Center (DMSC) and the Finite Element Analysis (FEA) Design Center, while the Gear Making and Assembly Facility (GMAF) is already halfway through its implementation. The PD is progressively adopting strategic and innovative approaches in ensuring the industry's continuous access to latest technology alternatives and sustaining R&D investments in partnerships with Technology Solutions Providers (TSPs), in preparation for the setting up of new facilities in 2016 like the Center for Advanced Welding and Fabrication (AWF), the Center for Advanced Mechatronics and Robotics (AMEROB), and the Center for Innovation and Advancement of Manufacturing Technologies (CIAMT).

Accentuating further the achievements of PD in 2015 were the internationalization of its activities in terms of creating new partnerships, acquisition of modern equipment, and availment of foreign training for PD engineers, technicians and staff, and the presentation of R&D outputs to international conferences/fora that has earned them various awards and recognition. This fruitful year will not have come to pass if not for the collective talents and accomplishments of PD personnel and the support of the DOST-MIRDC Management. 2015 is PD's most celebrated year with a theme "Prosperity in Diversity: The Value Inspired Personnel (PD: VIP)" highlighting the greater importance and valuable contribution of everyone in achieving the Center's Vision and Mission to become a Center of excellence and for a globally competitive metals, engineering and allied industries.

HIGH IMPACT TECHNOLOGY SOLUTIONS (HITS)

IMPROVEMENT AND ROLL-OUT OF FOOD PROCESSING EQUIPMENT

The DOST High Impact Technology Solutions (HITS) Program involving the design and development of food processing equipment continues to achieve its objectives through the Rollout of DOST-Developed Food Processing Equipment to the Regions specifically at the Regional Food Innovation Centers (FICs). The FICs serve as venues for the demonstration of diversified and efficient production technologies by using locally-fabricated equipment.

Being deployed in the regions are: the Water Retort, which will be used widely for thermal processing of food in air-tight containers resulting to shelf-stable products even under non-refrigerated conditions; the Spray Dryer, which involves the atomization of a liquid feed-stock into a spray of droplets with hot air in the drying chamber; the Vacuum Fryer that allows frying of different raw materials such as root crops, vegetables and fruits under reduced pressure (vacuum) and lower temperature; the Freeze Dryers, used to preserve a perishable material for a more convenient transport wherein products retain flavours, aroma and nutritional content; and the Vacuum Packaging Machine (VPM) technology that is usually applied for long-term storage of dry foods such as cereals, nuts, cured meats, cheese, smoked fish, and coffee.

With the collaborative work of the DOST-MIRDC, the DOST-Industrial Technology Development Institute (DOST-ITDI), and the DOST-PMEDSO, some of the DOST-developed food processing equipment have been initially deployed to the FICs in Regions II, VI, VII, VIII, X, XI and NCR. The project team aims to complete the deployment of equipment and extensive training of personnel to all the eighteen (18) regional FICs soon to be established before the end of 2016.

The DOST-MIRDC played a vital role in project implementation especially on activities relating to design and fabrication, acceptance testing, deployment, installation and commissioning of equipment to the different regional FICs nationwide.

The DOST-MIRDC is now paving the way for nationwide technology transfer through the use of promotional videos and licensing of local fabricators. Through the adoption and commercialization of these technologies, the DOST-MIRDC aims to enable our SMEs to produce innovative and competitive food products and catalyze inclusive growth in the countryside.

DOST-Developed Food Processing Equipment.

Another support project on "Building Up Technology Assistance to Fabricators" is in progress that will capacitate our local fabricators to be very responsive in addressing the requirements of DOST, and more so, in providing and sustaining high quality services and support for the local food processors and meeting the equipment fabrication requirements of the various regions.

DOST Project Team from PCIEERD, ITDI, MIRDC, and PMEDSO.

Project meetings and onsite visits to fabricators.

MACHINE BUILDING AND LOCALIZATION/ AGRICULTURAL MECHANIZATION

LAND PREPARATION, IRRIGATION AND FARMING

Design and Development of Hand Tractor Attachments

Realized through the funding support of the DOST-PCAARRD, and in partnership with the PHilMech under the program "Enhancing Rice Production and Postproduction Efficiencies through Improvement and Use of Appropriate Mechanization and Postharvest Technologies," prototypes for rice transplanting and harvesting implements that can be readily mounted to and dismounted from the common hand tractor were developed to significantly increase further the utilization of hand tractor in farm areas as well as to reduce the cost of farm level mechanization that will directly benefit the farmers, rice field owners and planters.

Design and Development of Transplanter-Attached Hand Tractor

A series of functional and performance testing of transplanter-attached hand tractor was conducted in Nueva Ecija and Tarlac to establish several operation-related parameters such as the time required for the transplanter implement to be hitched to and detached from the hand tractor, turning radius, speed of transplanting operation, depth of transplanting and number of seedlings planted, among others.

Modifications and revisions of the transplanter-attached hand tractor prototype were carried out based on the results of the testing for the improvement of the said prototype. In comparison to commercially available transplanters, the transplanter-attached hand tractor prototype has unique features in which the transplanter can be readily assembled to and disassembled from the common hand tractor, thus, adding value and enhancing the use of the existing hand tractor. Basically, a hand tractor can perform rice field preparation processes such as plowing, tilling and harrowing. All commercially available rice transplanters are self-propelled and dedicated machines wherein their function is limited to transplanting only. The transplanter-attached hand tractor is driven by a 7-hp diesel engine with a capacity of 0.5 hectare per day through its 6-row planting capability. Its planting distance is within 20 to 25 cm as required by the Philippine Agricultural Engineering Standards (PAES). Furthermore, it also has adjustable planting depth comparable to commercially available transplanters.

The field testing was very valuable in addressing some issues and improving the design of the fabricated prototype. With a few minor adjustments, the transplanter-attached hand tractor is capable to efficiently transplant rice seedlings. Soon enough, with the members of the project team focused to constantly improve its design, our farmers will be maximizing their production while minimizing manual inputs.

Identified Specifications	Targets Specifications of Harvester Prototype	Remarks
working width	0.8 meter	comparable to self-propelled commercially available rice combine harvester
working efficiency	500 m^2 per hour	
loss ratio	≤ 3.5%	
impurity ratio	6%	
power requirement	minimum of 7 HP; varies depending on the engine of a hand tractor	

Design and Development of Harvester-Attached Hand Tractor

Conceived to address the needs and problems in the current agricultural situation of the country, as well as to promote locally developed technologies by mechanizing the agriculture sector through S&T, the project aimed to design and develop a harvester-attached hand tractor. The said technology aims to enhance the performance and productivity of the prevailing manual equipment used by local farmers.

In 2015, the design and assembly of harvester-attached hand tractor prototype were completed. Having the same principle with the transplanter-attached hand tractor prototype, the harvester-attached hand tractor prototype promotes simplicity in design and offers convenience to its operators since the harvester implement can be readily mounted to and dismounted from a common hand tractor. Shown below is the harvester-attached hand tractor prototype which drives the project team to achieve the targets and determine the results through a series of field testing in 2015.

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

The DOST-MIRDC continues its partnership with the PHilMech in further assessing the functionality of the locally fabricated prototypes of hand tractor attachments (harvester and transplanter) that were developed in 2014 through the project entitled, "Design and Development of Hand Tractor Attachments (Harvester and Transplanter)." The new project commenced last February 2015 and is expected to run for a period of 18 months with the DOST-PCAARRD as the funding agency. The Center undertook the necessary documentation and standard process for the bidding for the supply of labor and materials for the fabrication of three (3) units of transplanter-attached hand tractor which, at the later part of 2015, was awarded to Gecar Machine Solutions, Inc. Meanwhile, the bidding for the fabrication of three (3) units of harvester-attached hand tractor is yet to be arranged in the first quarter of 2016.

Although the field testing of three (3) units each of transplanter and harvester prototypes in several test sites within Regions 2, 3, and 4 are scheduled in Q1 and Q2 of 2016, prospective adopters/ beneficiaries were already identified in coordination with the PHilMech, the DA and the DOST Regional Offices.

Furthermore, necessary documents for Intellectual Property (IP) registration are already in-process alongside the economic viability and social acceptability analysis. Other expected outputs of this project prior to its culmination in 2016 are the test protocols and operations manual.

HARVEST AND POST-HARVEST EQUIPMENT

Development of Fluidized Bed Dryer (FBD) for Production of Stabilized Brown Rice (SBR)

The consumption of brown rice has been identified as a cost-effective way of contributing significantly to rice self-sufficiency because of its higher milling recovery, lesser equipment investment and higher nutritional value. However, brown rice cannot fully proliferate in the market because of its short shelf-life. In an effort to address this concern, the DOST-FNRI is conducting studies on how to prolong the shelf-life of newly de-hulled brown rice from the average of one to three months to five to nine months. Experiments by the DOST-FNRI revealed that a combination of steaming and fluidized bed drying is an effective method of increasing the shelf-life of brown rice by five to nine months without any significant effects to its nutrient contents, physicochemical, chemical and microbiological properties.

Since 2014, the DOST-MIRDC, with funding support from the DOST-PCAARRD, is continuously developing a batch-type Fluidized Bed Dryer equipment to carry out the process. The equipment, with a capacity of 50 kg per batch using rice hull for drying and LPG for steaming, is undergoing evaluation at the Philippine Center for Postharvest Development and Mechanization (PHilMech) in Nueva Ecija. Trial run results show that a steady activity of the free fatty acid, the main factor to shelf life, has been detected. Other factors such as sensory, water activity, moisture content, pH, etc. are under observation.

Optimization of the process is ongoing to determine the proper combination of parameters with the temperature and duration of exposure for the production of stabilized brown rice. Further, modifications on the furnace, heat exchanger and cyclone are expected to be completed within the first semester of 2016.

Batch-Type Fluidized Bed Dryer

Steamer

Fluidized Bed Dryer

Fluidized Bed Dryer Chamber

Retrofitting of Compact Rice Mill System for Brown Rice Production

A compact rice mill, also known as 'Cono' in the Philippines, can enhance brown rice production when retrofitted. This modification allows rice mill owners to engage in production of brown rice without sacrificing the mill's capability to produce well-milled rice. Moreover, retrofitting saves considerable amount of money compared to buying another rice mill specific for brown rice.

The DOST-MIRDC, in cooperation with the Department of Agriculture, through the PHilMech and funding support from the DOST-PCAARRD, successfully retrofitted and pilot-tested a compact rice mill for brown rice production at Catalanacan, Science City of Muñoz, Nueva Ecija. The said compact rice mill is from an agricultural cooperative, the Catalanacan Multi-Purpose Cooperative (CAMPC).

In 2014, the project team successfully completed the retrofitting of a prototype of compact rice mill at the PHilMech. The learnings from the study led to the successful retrofitting and pilot-testing of the CAMPC's compact rice mill system.

CAMPC is one of the cooperatives that produces a large amount of milled (white) rice in the Science City of Muñoz. The CAMPC is now producing 22% of brown rice from their original production, with an approximate increase in milling recovery by 10.81% in its brown rice products. Based on the economic viability study, this would result to a significant increase in income of the cooperative. Another positive feedback from the CAMPC is that there are several paddy traders that are already committing to avail of brown rice milling services from them.

In August 2015, the project was successfully launched at the PHilMech Training Hall inside the Central Luzon State University (CLSU) Compound., Science City of Muñoz, Nueva Ecija. The launching event was participated in by the DOST and the DA, media, PhilRice, DOST-PCAARRD, Mariñas Technologies, Inc., the CAMPC, DOST-FNRI, farmers, and other cooperatives in Nueva Ecija. The highlight of the program is the presentation and demo of the project which was facilitated by Engr. Nico Deus O. Villafranca of the DOST-MIRDC and Engr. Reynaldo P. Gregorio of PHilMech.

Endurance test of CAMPC's retrofitted compact rice mill.

Launching of the project on "Retrofitting of a Compact Rice Mill for Brown Rice Production" at PHilMech Training Hall.

Project presentation by Engr. Nico Deus O. Villafranca.

Project demonstration by Engr. Reynaldo P. Gregorio.

Technical Forum on the Retrofitting of Compact Rice Mill.

Design and Development of Superheated Steam Treatment System for Stabilized Brown Rice (SBR)

This project is being implemented to support the national program of the government for rice sufficiency, as well as to address the DOST R&D Program for Brown Rice in identifying the factors affecting the stability and acceptability of brown rice. It is a collaboration project of the DOST-MIRDC and the DOST-Food and Nutrition Research Institute (DOST-FNRI) with funding support from the DOST-Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (DOST-PCAARRD). It aims to design and develop a prototype batch-type Superheated Steam Treatment System (SSTS) that will extend the shelf-life of brown rice from 1-2 months to 5-9 months.

Using the machine, prolonged storage of a commercially available variety of brown rice is made possible that eventually benefits producers, traders and retailers as well as consumers in terms of consumption and availability of more affordable brown rice in the local market. The batch-type SSTS machine has a design capacity of 10 kgs/batch with an overall dimension of 2.7 meters long, 1.4 meters wide and 1.7 meters high. The support frame is made up of mild steel square tubes, while the treatment chamber, where the sample of brown rice is placed during treatment, is made of food grade stainless steel sheets. Superheated steam up to 300°C is supplied by a boiler which can generate pressure of 70-100 psi. The system is developed together with the DOST-Project Management and Engineering Design Services Office's (DOST-PMEDSO) support on the technical aspects, the DOST-FNRI on the physico-chemical and chemical analysis of the treated brown rice, and Mariñas Technologies, Inc. on the fabrication of said equipment.

To meet the objective of extending the shelf life of the brown rice, several runs of the system were conducted such as observation, optimization, and standardization. Treated brown rice in each run were physico-chemically and chemically analyzed by the DOST-FNRI technical staff to determine the system parameter settings that give the best result in extending the shelf-life of brown rice without losing its important nutrients during treatment.

In 2015, setting of the batch-type SSTS was established through standardization run. The results of the physico-chemical, FFA and sensory evaluation according to the DOST-FNRI are as follows: 95% confidence level, no significant difference on moisture, water activity and delta FFA among the treated samples. These indicate that the SSTS optimum parameters were standardized and repeatable. The average delta FFA was 1.09%. The actual data gathered from the free fatty acid analysis after 3 weeks were within 95% confidence level of the predicted value of the model.

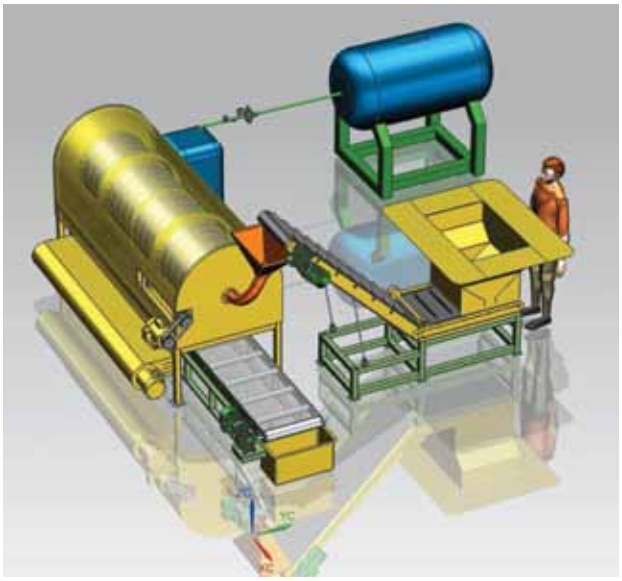
After establishing the optimized parameters, production of superheated steam treated brown rice for storage was conducted. Observation on actual and accelerated shelf-life of treated brown rice samples is now on-going at the DOST-FNRI Laboratory. The superheated steam treated brown

Dr. Guevarra explains the batch-type SSTS during its launching.

rice samples are stored at 30, 35, 40 and 45oC using different laboratory incubators.

Launching of the batch-type SSTS was conducted on December 16, 2015 to present the system and technology to the public. It was attended by millers, traders and cooperative members. A sample of cooked brown rice was served and fortunately, a positive impression was heard from all who tasted it.

Another system to be prototyped through this project is the continuous-type SSTS. Fabrication of the system is ongoing. The Pulilan Rice and Vegetables Production Cooperative signified interest to be the cooperator of the continuous-type SSTS.



Superheated Steam Treatment System

OTHER AGRICULTURAL PROCESSING EQUIPMENT

Design and Development of a Forage – Blade and Chopper for Goat Production

Corollary to the implementation of the National Dairy Goat S&T Program led by the CLSU and funded by the DOST-PCAARRD, the DOST-MIRDC is developing a forage–blade and chopper for goat production. The project aims to support the blade requirements of forage choppers in the Philippines, particularly forage chopper for Indigofera zollingeriana, a medium-sized nitrogen fixing tree which can stabilize milk production for goats and reduce cost of feeds. Study showed that the use of 40% pure Indigofera zollingeriana in the ration could reduce feed conversion ratio and costs by about 42% for the Saanen and 15% for the Etawah Crossbreed. To improve absorption of Indigofera zollingeriana as feed for goats, chopper is necessary to reduce it into manageable sizes. Presently, a number of locally fabricated forage choppers are accessible, however, the quality of blades needs improvement for enhanced reliability and optimized use of choppers. The same will prevent cost escalation in terms of labor and wastage of the fodder. A chopper suited for a tree legume like Indigofera zollingeriana will be likewise advantageous.

By the first semester of 2016, the project is expected to have designed and developed the most appropriate blades for existing choppers along with a forage chopper for an Indigo zollegeriana blended dairy concentrate leaf meal.

A side-cutting chopper with new blade under functional test .

Sample of chopped forage from the side-cutting forage chopper.

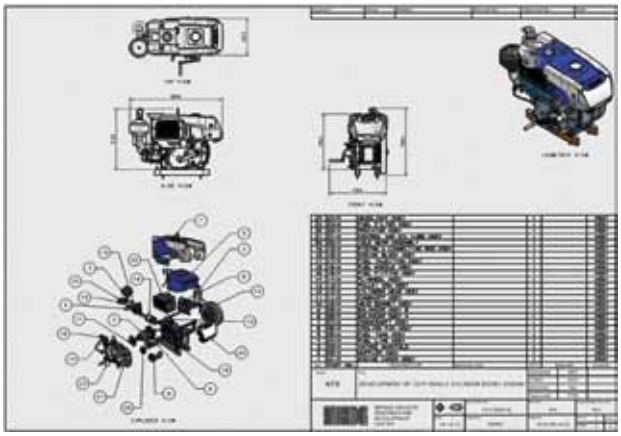
Development of 12-Hp Single Cylinder Diesel Engine

The development of the 12-horsepower single cylinder diesel engine is now on its second year of implementation in close collaboration with different partners in the metals and engineering (M&E) industries. This move is not only to strengthen partnerships among key players in the industry but also to demonstrate the readiness of the local industry in producing locally-developed 12-horsepower single cylinder diesel engines.

All engine 3D modelling and engineering drawings for engine production were completed in 2015. Drawings in 2D were already evaluated by the DOST-MIRDC Quality Assurance unit and final tolerances of the engine parts were already determined.

Fabrication and machining of the different engine parts and components of the 12-horsepower single cylinder engine has also commenced. Some engine components, particularly the flywheel, camshaft, crankshaft, and the engine block, were cast by the Supercast Foundry and Machinery Corporation and are currently under analysis by the DOST-MIRDC's Quality Assurance unit. Small engine components are being cast at the DOST-MIRDC Foundry. The project also tapped E.A. Rañola Machine Shop to fabricate and machine some of the engine components. Fabrication of the radiator is ongoing at Roberts Automotive and Industrial Parts Manufacturing. Gear fabrication, commissioned to Rockwell Machine Shop, is ongoing. Replication machining of the engine's main parts and components, which include the engine block, crankshaft, balancer, and camshaft, was contracted to Mesco, Inc. Assembly and testing of the engine are expected to be completed by the first semester of 2016.

Engr. Allan John Limson and Engr. Joein Luces, project team members, also presented a paper entitled, "Capability Building: An Approach to the Development of a Locally-made Single Cylinder Diesel Engine" in the 12th International Agricultural Engineering and Exhibition during the 65th Philippine Society of Agricultural Engineer's Annual National Convention, and in the 26th Philippine Agricultural Engineering Week held last 19-25 April 2015 at the KCC Convention and Events Center and the Mindanao State University in General Santos City. The paper won 2nd Best Technical Poster in the said event.



Engine assembly drawings

Single Cylinder Project Team at work.

SPECIAL PURPOSE INDUSTRIAL MACHINES

Design and Development of a Local Microwave Vacuum Dryer

With the project already closing in towards its conclusion since its first implementation in 2014, the DOST-MIRDC project team continues its collaboration with the University of the Philippines – National Institute of Physics (UP-NIP) and the DOST-PMEDSO in optimizing the performance of the local microwave-vacuum dryer (MVD) and testing its drying operations on commodities such as strawberry, garlic and chili. All obtained drying results were found to be acceptable based on available standards.

Also, to promote the MVD's application to local industries, a formal launching of the project was conducted on December 9, 2015 at the Platinum Conference Hall of the PD Building in the DOST-MIRDC Compound. The event was attended by participants from research institutions, local fabricators, students from state colleges and universities and other interested parties.

Likewise, the MVD project has already been presented to a number of local and international conferences including: the 7th IEEE International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM) in Puerto Princesa, Palawan where it won the "Best Poster Paper"; the ASEAN FOOD Conference at the MOA SMX Convention Center; the International Multiconference of Engineers and Computer Scientists on March 16-18, 2015 in Hongkong; and the World Congress on Engineering and Computer Science on October 21-23, 2015 in San Francisco, California, USA.

Microwave Vacuum Dryer

The MIRDC Project Team.

Project Presentation in WCECS 2015 in San Francisco, California, USA.

Moisture Content (MC) reduction in some commodities using MVD

INITIAL MOISTURE CONTENT : 63.182%	INITIAL MOISTURE CONTENT : 75.314%	INITIAL MOISTURE CONTENT : 91.302%
FINAL MOISTURE CONTENT : 8%	FINAL MOISTURE CONTENT : 10%	FINAL MOISTURE CONTENT : 9.9%

Garlic

Chili

Strawberry

Prototyping and Pilot Production of Eyelet Riveter/Eyelet Machine

The DOST-MIRDC is jointly developing the Eyelet Riveter /Eyelet Machine in cooperation with the Office of Consular Affairs – Authentication Division (ADOCA) of the Department of Foreign Affairs (DFA). The said machine is basic in binding and attaching ribbon on consular documents. The existing Eyelet Riveters of ADO-CA are imported and the supplier is no longer available while the surviving units are barely functional due to more than two decades of usage.

To meet the continuing requirement of the DFA for eyelet riveters, a partnership was forged between the DOST-MIRDC and the DFA through a MOA signed on April 23, 2015. With the funding support provided by the DFA, the DOST-MIRDC initially submitted three prototypes being subjected by the ADO-CA to actual evaluation and acceptance tests. Thereafter, the DOST-MIRDC will pilot produce 130 units to be delivered in three tranches within 2016.

The original Eyelet Riveter (above) and the approved design.

Casting of Eyelet Riveter parts.

Development of Heavy Duty DC SMAW/GTAW Inverter Welding Machine

In support to the Makinarya at Teknolohiya Para Sa Bayan (MakiBayan) initiative of the DOST in recognizing and addressing equipment needs that will enhance the performance and productivity of various industries in the country, the DOST-MIRDC, in cooperation with the Philippine Welding Society (PWS), locally developed a heavy duty DC inverter shielded metal arc welding – gas tungsten arc inverter (SMAW/GTAW) welding machine at 20% less cost than the commercial leading brands.

The project is an S&T response to curb the importation of welding machines by locally developing a low-cost DC inverter welding machine. The welding machine to be offered to the welding industry at a much lower cost is designed with a better level of favorable features suitable to small and medium enterprises.

An inverter welding machine is an equipment that provides electric current utilized specifically for welding. Compared to the traditional transformer-rectifiers, the inverter is more portable and light eight. In addition, it offers high quality and multi-process welding capabilities. Basically, inverter welding machines are made of Metal–Oxide–Semiconductor Field-Effect Transistor (MOSFET) rectifiers and in order to cope up with the volume of work load, this machine uses the technology of Insulated-Gate Bipolar Transistor (IGBT). The IGBT is a three-terminal power semiconductor device primarily used as an electronic switch.

Such inverter type welding machine has several advantages over the traditional transformer type welding machine. Though both machine types require a transformer to convert incoming voltage to suitable welding voltage, conversion can be done more efficiently with an inverter type. The result is a substantial reduction in size and weight of the transformer and a decrease in power consumption as the more efficient transformer loses less energy to heat.

Project-related activities include testing of laboratory prototype, conduct of free welding training, and field testing of developed prototype at the power generation facilities in Batangas, Bataan and Olongapo City.

Parameters	Commercially Available Inverter DC Welding Machine	Target Prototype	Remarks on Target Prototype
Input Voltage Range	mostly 220-240 Volts, 3-phase	220 Volts, single-phase	can be readily tapped to common power source ; no additional transformer required
Duty Cycle	30% - 60%	30% - 60%	Comparable
Output Current Range	mostly up to 200 Amperes	200 to 250 Amperes	Heavy duty welding machine
Mobility / Portability	with wheels on base of machine	portable and with wheels on base	lightweight

Design and Development of Polyethylene Metbuoy

The DOST-MIRDC, in cooperation with the DOST-Advanced Science and Technology Institute (DOST-ASTI), has finally developed a polyethelene-based buoy that can suitably support its hull and superstructure. It is an ocean meteorological buoy for weather monitoring. The masts, however, and the poles for the mounting of the instruments were made of stainless steel. The hull is 2 meters in diameter while the height is 6.08 meters (excluding the mooring yoke) and weighs about 500 kg. The polyethylene metbuoy was deployed with a depth of 25 meters in the waters of Matnog, Sorsogon in October 2015.

The meteorological buoy system monitors the changes at sea especially during extreme weather conditions, and provide accurate and timely information to prevent sea accidents and tragedies. This polyethylene buoy is manufactured from UV-stabilized virgin polyethylene which protects it from the destructive ultra violet rays of the sun and has been specifically designed to withstand the harsh marine environment.

This model is an improvement from the all-steel composition of the initial versions. Polyethylene no longer requires painting since the color pigment is already added during the molding process. Likewise, corrosion and marine life growing around the met buoy is no longer a problem which reduces the maintenance to the minimum.

DOST Metbuoy version 2.0 moored approximately 1 km away from the shoreline of Calintaan Island, Sorsogon.

INSTITUTIONAL DEVELOPMENT AND CAPABILITY BUILDING

COMPETITIVE ADVANCEMENT OF TECHNOLOGIES AND COMPETENCIES AND OF HUMAN RESOURCES UPGRADING PROGRAM (CATCH-UP)

Gear Making and Assembly Facility

With the MakiBayan initiative of the DOST which aims to improve the competitiveness of the local metalworking industry that was formalized through an MOU signed initially with the Metalworking Industries Association of the Philippines (MIAP), the Gear Making and Assembly Facility will be established to mark the DOST's dedication in molding the future of the metals industry. It will be put up to support the Sustainable Mass Transport System Program of the DOST.

This facility largely aims to enhance local capabilities for gear design and prototype production, and to develop gear assembly manufacturing industry for transport, metalworking and agro-industrial applications. One of the objectives of the project is to design, develop and produce specialized gears and gearboxes for the train set and for those MIAP-identified outputs expected by the industry. It intends to provide facility-sharing services on the production of gears and transmission system as well as developing training curriculum for gear design and manufacturing. The gear making facility is housed at the newly renovated Mechanical Workshop I Building of the PD.

One of the machines that is already being utilized in the Gear Making Facility is the Gear Measuring equipment used to measure straight or slanted-tooth spur gears, conically corrected gears, inner and outer gearing, beveloid and splines, pinions and ring gears, as well as worms and screw compressors.

The DuraMax RT is a bridge-type measuring machine with a rotary table. The rotary table enables the user to increase their flexibility and save measuring time.

In the second quarter of 2015, MIRDC Officer-in-Charge Robert O. Dizon, together with PD Chief, Engr. Fred P. Liza, Project Leader Dr. Dominic S. Guevarra, and Lab Inspector Noli P. Alvior, conducted the factory acceptance or buy-off of the gear measuring machine in Oberkochen, Germany. The team also went to the University of Glasgow in Scotland for a possible research collaboration and discussed other opportunities specifically in the areas of gear design and system optimization and FEA simulation.

Among the other equipment that will be used in the facility are the CNC 5-Axis Machine (multitasking function, toolings and accessories), CNC Gear Hobbing Machine, Dynamic Balancer, Gear Shaper, Gear Shaver and Vacuum Carburizer.

Discussions during the buy-off of gear measuring machine in Oberkochen, Germany last May 2015.

Photo taken at the University of Glasgow in Scotland (from left: Dr. Dominic S. Guevarra, Engr. Fred P. Liza, Engr. Robert O. Dizon, Prof. James Conroy and Prof. Trevor Hoey).

Die and Mold Solution Center (DMSC)

Die and Mold Solution Center

The completion of the Die and Mold Solution Center (DMSC) will be a big boost in enhancing the competitiveness of the local tool and die industry particularly in localizing dies and molds which are currently imported. New technologies have been acquired involving software packages and capabilities for computer-aided design/manufacturing/engineering (CAD/CAM/CAE) such as NX, Cimatron, Altair-Solista, Moldex3D and Solidworks.

From 2013 to 2015, 33 major equipment were installed, which include advanced CNC machining (e.g., 5-axis multitasking, high speed), 3D printing, and CNC cutting (e.g., laser, router, plasma). Additional 3-axis CNC machines and vertical machining centers, CNC EDM wirecut and sinkers, surface grinders, punch press, hydraulic shear, die spot press, power press, CNC CMM with laser scanning and vision system, and other auxiliary equipment were put in place to complement the existing CNC machines at the DOST-MIRDC. Access to these advanced dedicated technology and facilities on die and mold designing and making were provided and offered to SMEs through a shared-service-facility scheme at reasonable rates. In relation to this, 25 DMSC engineers and technicians underwent rigorous training programs within and outside of the country to learn new techniques and good manufacturing practices in countries like Japan, Germany, China, Malaysia and Singapore, especially for the newly acquired hardware and software. DOST-MIRDC and industry personnel also attended technical seminars in cooperation with the DOST-MIRDC's technology partners covering various topics on current and near future trends in manufacturing industry, latest technology in multitasking and 5-axis machining, special applications

D2M2 Graduates with MIRDC Management and PDMA, Inc.

in cutting exotic materials, optimization of machine uptime presetting, and logical approaches to die and mold machining, among others. These seminars were attended by more than 360 participants from the DOST-MIRDC, the industry and the academe. The DMSC likewise rendered consultancy services relevant to tool, die, and mold designing and making to private companies, particularly in the development of their designs up to machining and trial runs.

In time for the completion of the DMSC project in December 2015, a continuing collaboration with project partners was pursued to help ensure the sustainability of this strategic initiative. As an offshoot, a collaboration project was undertaken among the DOST-MIRDC, the PDMA, Inc., and the Board of Investments (BOI) entitled, "Enhancing Tool and Die Industry Competitiveness by Expanding the Pool of Trained and Highly Skilled Die and Mold Designers and Makers (D2M2 Project)." This is to utilize the DMSC facility for the training of additional four (4) batches of die and mold designers and makers, with 20 participants per batch. Three (3) projects are still in the pipeline for another possible funding support under the Department of Trade and Industry's (DTI) Industry Development Program (under the Manufacturing Resurgence Program) that will complement the operation of the DMSC such as: (1) the D2M2 Project that aims to train additional 400 die and mold specialists in the next three years; (2) Capability Building for Enhancing the Competitiveness of Die and Mold Industry Through the Engagement of Local and Foreign Experts (DiMo Guru) to engage local/ foreign die and mold consultants; and (3) Developing Competencies and Certification Schemes of the Die and Mold Specialists and Practitioners in the Philippines for the next three years.

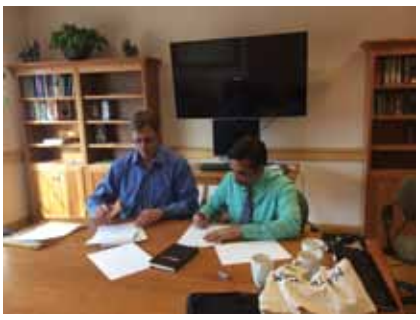
To further complement the establishment of the DMSC, the DOST-MIRDC established linkages/ partnership with companies here and abroad. In August 2015, the signing of a Memorandum of Agreement (MOA) was undertaken with the DMG-Mori Seiki Company Ltd. and the Teknologix, Inc. The DMG-Mori will provide advanced CNC machines/equipment to be installed at the DOST-MIRDC for demonstration for both educational or research purposes. The Teknologix, Inc. will provide the DOST-MIRDC with the necessary license/s of Siemens PLM software for trainings and R&D activities. Also, a Memorandum of Understanding (MOU) was signed with the Korea Association of Machine Industry (KOAMI) for

MOA Signing with DTI-BOI.

joint study of designing an ODA model for the establishment of the Mold Technology Support Center (MTSC). Another MOU was signed in October 2015 with the CNC Software, Inc. and Techline Machine Tools, Inc. for the provision of 21 free educational licenses of Mastercam software to be used by the DOST-MIRDC for public trainings and R&D activities. Finally, the University of Glasgow (UoG) signed a MOA with the DOST-MIRDC last September 2015 to develop academic and educational cooperation for the conduct of joint R&D activities and staff development programs particularly MS and PhD degree programs for DOST-MIRDC personnel.

MOU Signing with DMG-MORI.

MOU Signing with Teknologix.




MOA Signing with CNC Software Inc.

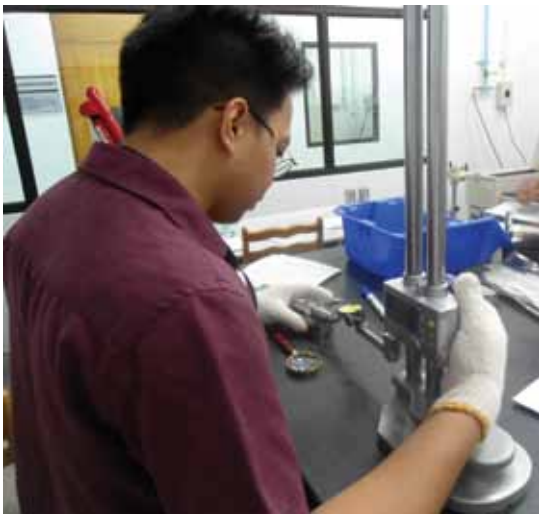

MOU Signing with UoG.

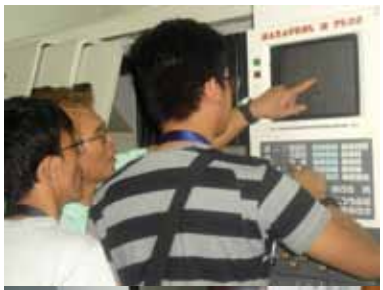
Die and Mold Designing and Making (D2M2) Training Program

The implementation of a project on D2M2 addresses the aim to enhance the country's tool and die sector by developing a pool of die and mold designers and makers. The DOST-MIRDC, in cooperation with the PDMA, Inc. and the DTI-BOI, together with the different TSPs and Partner Support Organizations (PSOs) implemented four (4) batches of the D2M2 training program which aims to train individuals and enhance their skills in both design using CAD/CAM software and fabrication of simple and complex dies and molds in accordance with the ISO standard. The training participants took the preparatory courses – Technical Drawing, Dimensional Metrology, Material Selection, Safety and Maintenance and Heat Treatment. This is followed by machining and programming courses – CNC Turning and Milling, CNC-EDM Wire-Cutting and Sinking, and CNC-5-Axis Machining. Finally, the trainees engaged in the major courses in designing – CAD Fundamentals and the specialized courses – Die Design and Plastic Injection Mold Design.

On 01 July 2015, the second batch of trainees, comprising of 20 qualified industry personnel, were introduced at the Platinum Auditorium. They are the training beneficiaries who qualified based on the entry level requirements set by the TWG particularly on education, experience and knowledge on designing and machining. This batch is expected to graduate in February 2016. The third batch of trainees which started on 01 October 2015 will graduate in May 2016.

Acknowledging the essential contribution of the academe to the preparation and development of future skilled workforce of the tool and die sector, the DOST-MIRDC and the PDMA modified the curriculum of the 4th batch of the D2M2 training program to suit the requirements of academic personnel. Thirteen faculty members/instructors were enlisted by their schools and universities to join the program in order to upgrade and update their knowledge and skills using advanced technology on die and mold designing and making. The faculty members/instructors were officially introduced as Batch 4 trainees last 04 December 2015.





Opening Ceremonies
Batch 2, 3 & 4

Materials & Process

The Materials and Process Research Division (MPRD) is divided into two sections: The Process Research Section (PRS) which specializes in metalcasting services using its investment and conventional casting facilities; and the Materials Research Section (MRS) which focuses on surface engineering services such heat treatment, electroplating, pulse plating and anodizing. The MPRD as a whole offers technical assistance through Contract Researches and PRS facility time-sharing. The division also takes pride in the implementation of the DOST's major research and development projects such as the Development of AGT Systems in UP Diliman and Bicutan, the Development of Prototype Trainset, and Establishment and Upgrading of the Center's Surface Engineering Facilities.

Driven with a deep commitment to achieve targets, the MPRD was truly inspired to use science, technology, and innovation in the implementation of various projects under several high impact programs – all for the enhancement of the productivity and global competitiveness of the metals, engineering and allied industries and for the longer-term benefits for the nation.

SUPPORT PROGRAM FOR THE PRODUCTIVITY AND COMPETITIVENESS OF THE METALS AND ENGINEERING INDUSTRIES

Test and Evaluation of 120-Passenger per Coach Capacity Automated Guide-way Transit System

At present, the country has been battling with the worsening problems on vehicular traffic congestion and air quality situation. These problems are among the major challenges hindering the country's economic growth, thus the need for sustainable technology alternatives in the transport industry is imperative. According to the data from the Department of Environment and Natural Resources' Environmental Management Bureau (DENR-EMB), air pollutant concentration for the first quarter of 2015 in the National Capital Region alone reached 130 micrograms per normal cubic meter (µg/Ncm) in terms of total suspended particulates (TSP), up from 106 µg/Ncm at year's end in 2014. It was noted that the maximum safe level of air pollutant concentration is 90 µg/Ncm only. According to the partial results of the National Emissions Inventory in 2012, 71 percent of air pollution comes from vehicles on the road. This number is even higher in the National Capital Region (NCR) where 85 percent of air pollution comes from vehicles.

Through the Metals Industry Research and Development Center (MIRDC) of the Department of Science and Technology (DOST), with the help of the private sector and the academe, the development of an Automated Guide-way Transit (AGT) system was made possible. This is perceived to be a viable alternate mode of public mass transport that may address the problems on vehicular traffic congestion and air pollution in the country. The project was launched in 2010 and had its maiden run of the first complete prototype at the University of the Philippines Diliman (UPD) on December 2012. The prototype can carry only 30 passengers per coach.

Automated Guideway System at Bicutan.

After the successful development of the UPD prototype, the DOST-MIRDC embarked on a bigger and improved AGT System in Bicutan, Taguig City, taking into consideration the learnings gained from the first prototype. This AGT System version is composed of two coaches, which has 120-passenger capacity each coach, making it comparable with the existing railway transit in the country such as the Metro Railway Transit (MRT) and Light Railway Transit (LRT) in terms of size and capacity.

In line with the development of AGT-Bicutan, the project "Test and Evaluation of 120-Passenger per Coach Capacity Automated Guide-way Transit System" was launched in 2014 to validate the improvements made, identify areas that need further improvements or modification, optimize operation parameters, and evaluate the response of the system to certain conditions. This project specifically aims to test and evaluate the performance of the 120-Passenger per Coach Capacity of the AGT in terms of its safety, energy, and technical viability.

The tests were divided into three (3) phases, namely; Functional, Performance, and Endurance Tests. Functional tests aimed to test and evaluate if each part and components function correctly based on the intended design and was done under No Load condition. The Performance tests aimed to test and evaluate the system on three different load conditions, namely: No Load, Full Load, and Crush Load condition. Speed, braking distance, vibration, rate of wear and tear of critical components among others were the parameters tested. The Endurance test was performed to test the limits of the AGT by running continuously for 8 hours a day for one (1) month using maximum weight (crush load condition). The longest single day non-stop test run was 14 hours. Restricted by the track's length of 372 meters, test runs were conducted at maximum speed of 25 kph.

Demonstration runs were also conducted to various stakeholders as part of the technology promotion. Feedbacks and comments were also solicited to gauge the riding public's perception on the technology and possible improvements.

Simulation and Evaluation of AGT System Passenger Stations – Phase 2

The AGT System at the UPD in Quezon City has been in research and development for more than three years. As part of the continuous design and improvement of the system, passenger stations were established which consisted of the following components: passenger stations, safety features, communication systems, and automated fare collection systems. All of these components are crucial in effectively demonstrating the AGT system. However, it is also important to ensure that the system will be managed properly and safely. Thus, the project entitled "Simulation and Evaluation of the AGT System Passenger Stations" is necessary as it includes management and maintenance of the passenger stations taking safety into first consideration.

This project aimed to achieve an AGT system passenger station that is efficient in layout and has a well-organized operation through simulation and evaluation. In line with this, the project team provided free demonstration rides to UP students, personnel and residents for a month in order to determine the likelihood of public acceptance and assess how well it would meet the urban transportation needs. The communication systems, safety features and the ticketing system of the stations were demonstrated to the public.

In preparation for the development of a commercial AGT, there were several modifications made based on data gathered from tests and evaluation of the AGT in 2014. The recommended improvements are the fabrication and installation of retainer assembly, automation of the stations' sliding gates, installation of traffic signaling system along the track and the stations. By these modifications,

Automated Guideway System in UP-Diliman, QC.

the AGT has come up with enhanced safety features and redundancy systems.

To further verify the technological reliability of the modified AGT system, performance and functional safety test procedures were conducted to evaluate the efficacy of the additional safety features installed on the improved system. These test procedures were conducted through automated run cycles.

The project is vital to gauging the public's acceptance of the AGT and ensuring that the system will be integrated effectively in the country's transport sector.

Passengers during the AGT System public demonstration run.

Mounted Retainer Assembly use to resist lateral overturning of the AGT.

Automated sliding gate at the platform area of the station equipped with motor, flashing light and safety sensor.

The Automated Fare Collection System consists of an AFC Software, smart card readers and automatic turnstile gates.

Development of a Prototype Trainset (Hybrid Electric Train)

At present, the Philippines faces a crisis in the transportation sector made evident by congested traffic resulting to wasted time and energy that directly impacts the development of the economy, protection of the environment and the welfare of the population. The railway system is considered a solution to the transportation crisis in the Philippines with its roster of advantages listed by European and other developed countries. These advantages include safety, speed, capacity, comfort, environmental protection, traffic jam reduction and economic feasibility.

With the aim to contribute to the modernization of transportation system in the Philippines, the DOST-MIRDC embarks on a project that would develop a prototype steel wheel Hybrid Electric Train (HET). This project is under the agency's Support Program for the Productivity and Competitiveness of the Metals and Engineering Industries.

There are three major railway systems currently operating in the country—the Metro Railway Transit (MRT), Light Rail Transit (LRT Lines 1 &2) and the Philippine National Railway (PNR). However, since the technology for these systems are outsourced from other countries, the Philippine government spends a big chunk of its budget for the patent and maintenance which on many instances it could no longer afford due to other major priority concerns. Both the government and the train-riding public end up investing on transportation that both could not be used to its full potential.

In view of the above, the DOST-MIRDC is working on the design and fabrication of a prototype trainset also known as the Hybrid Electric Train. The prototype HET operates on a diesel-electric hybrid system, which combines the use of a diesel generator and series of lead-acid batteries. It is envisioned to improve the current operations of the PNR by raising its efficiency while lessening the production and operational cost. This project also aims to utilize and maximize the capabilities of local industries in the fields of metals and engineering enabling the country to generate its own technology to address its needs in the area of transportation. The scope of work includes the development of a control system for the HET and the completion of a comprehensive material selection process for the local production of train parts and other requirements.

Activities undertaken, outputs and project milestones from January – December 2015:

- The project team conducted a bidding for the additional integration services, and additional unit of air compressed system for the prototype HET. The bid was awarded to BJ Marthel International Inc. and Janglo Trading and Construction, respectively.
- The project team, together with the Fil-Asia Automotive Industries Corporation, completed the delivery of ten (10) units of bogie assembly, and five (5) units of coaches at the project site in PNR Caloocan depot on March 31, 2015. The team assembled the coach and

Prototype Trainset at PNR Depot – Caloocan.

bogies using 45-tonner telescopic boom crane, transferring the assembled rolling stock inside the depot for electrical and mechanical integration.

- The project team, together with the DOST-MIRDC officials, approved the use of CC-Link Central System. The proposed system offers ease of maintenance, shortened installation time, reduced downtime, and ease in trouble-shooting for the prototype HET. Using this will be as efficient as that of using the previous hard wired system.
- The project team installed and tested the 500 KVA Diesel Generator set inside the power coach on June 10, 2015, and it was verified operational and ready for optimization. The Genset serves as the main power source of the prototype HET.
- The project team completed the installation of various train components towards the second quarter of the year. This includes the bogie side-bearer, motor coupling, ventilator, and other mechanical and electrical parts. The fabrication of a battery rack for 260 pieces lead-acid battery and additional electrical box is currently ongoing as well as the procurement of twelve (12) units of propeller shaft.
- To ensure that the objectives of the projects are met and properly implemented, the DOST-MIRDC project team, together with the DOST-Philippine Council for Industry, Energy, and Emerging Technology Research and Development (DOST-PCIEERD), conducted its quarterly monitoring on June 28, 2015. The key findings include the overall height of the prototype HET exceeding the standard height of PNR trains.
- The project team arranged a two-day training course regarding the application of CC-link and actual programming of PLC commands using GX Works2 Programming, by Engr. Ibarra Conception of ARROWSPEED Controls, for the controls of the prototype HET. The training was attended by DOST-MIRDC project team engineers and technicians.
- The project team conducted testing and commissioning of two (2) units of Air Compressed System (GAR7) from Janglo Trading. The equipment was concluded to be operational after running a series of test run and inspection at the PNR Caloocan depot. The requirements set by the team were done in complete adherence to the specifications.
- The project team, together with the representatives from DOST-Project Management, Engineering, Design Services Office (DOST-PMEDSO), Multiscan Corporation, and Dellner Singapore, successfully installed three (3) units of semi-permanent couplers from Dellner, Sweden. These semi-permanent couplers functions as a mechanism for connecting rolling stock in a train.
- The project team, together with Fil-Asia Automotive Industries Corporation, completed the modification and installation of perimeter seats and the height of the power coach air conditioning unit mounting. The team decided to modify the seats to strengthen its structure for the safety of the passengers.
- As of December 22, 2015, the project team has accomplished 95% of the integration process with the completion of the flexible conduit lay out, cable pulling, and installation of back plate, brake resistors and junction boxes. The other 5% comprises the finalization of controls, interlocking of electrical system, electrical auxiliaries and other electrically controlled equipment (battery, switches, lighting, sound system, intercom, etc.). The activities that are yet to start includes the last part of functional testing for each components and line testing outside the PNR Caloocan tracks.
- The project team is currently developing test protocols for the prototype HET. The final draft was already submitted to the DOST-PMEDSO for review.

JOINT RESEARCH AND DEVELOPMENT PROJECT WITH THE DOST-CORDILLERA ADMINISTRATIVE REGION (DOST-CAR)

Study on the Viability of Deploying Dost-Developed Mass Transport Technologies in Baguio City and La Trinidad

The growing demand for public transportation brought about by population growth and increasing urban land use developments requires a corresponding supply of public transport services to meet the demand. However, in most cities in the country, including Baguio City, such public transport services are mostly road-based low-occupancy vehicles which congest city roads especially during the peak hours. This traffic congestion results in undesirable delays and cause discomfort during the travel of people within the city. Moreover, the sheer numbers of road-based vehicles on city streets contributes

to air pollution which is harmful, not only to the environment, but also to the health condition of people.

To address the said issues, it is important to put up a public transport system in the city that will sufficiently service the travel demand of people in a manner that will minimize travel delays and reduce air pollution. This can be achieved hopefully by a mass transit system such as the DOST-developed AGT system for growing secondary cities, such as Baguio City and La Trinidad. Thus, a pre-feasibility study was conducted to determine on a preliminary level the viability of operating the AGT system along the identified service alignments. The DOST-CAR funded the study.

Transport and Traffic Planners, Inc. was awarded the contract as the consulting firm to conduct the study. Two study areas were initially selected: Baguio City and La Trinidad. The Central Business District was the identified alignment in Baguio City by the local government. On the other hand, the Baguio-La Trinidad highway was chosen for La Trinidad area. Both alignments were identified in coordination with respective local governments and DOST-CAR.

The final assessment for both alignments was found to be financially feasible. Also, as per clamor of the stakeholders to assess the feasibility of both lines combined, the result is also financially feasible. With this, several stakeholders expressed their support and interest in funding the project. To fully validate the results, a full blown study will be proposed.

SURFACE ENGINEERING PROGRAM

Upgrading of the Heat Treatment Facility

Heat treatment plays a vital role on the properties of metals. The process improves the properties of the final products suitable for its application. The environment of the process should be controlled to prevent scaling, decarburization, and oxidation. Distortion should be minimized and the overall process should also be environment-friendly. To offer these significant effects on heat treated material, the DOST-MIRDC refurbished an existing Vacuum Heat Treatment furnace.

Most of the vacuum heat treatment facilities in the country today are in-house; they only cater to their own products. On the other hand, there are few commercial vacuum gas quench facilities which offer higher cost on their services. The DOST-MIRDC's vacuum heat treatment service will

Techno-Demonstrations of Vacuum Heat Treatment Facility.

be offered with a competitive price which is based on rates of neighboring Asian countries to make this technology accessible economically.

Capability Development and R&D on Plating of Various Non-Conductive MaterialS

In the Philippine 2012 Industry Roadmap for the Automotive Parts Sector, among the strategies being identified for improving competitiveness of the local automotive manufacturing sector is the development of product technology, which includes the establishment of an auto R&D Center. The DOST-MIRDC, with its expertise and facilities, can locally develop automotive parts and components through its die and mold facilities.

This project is an important support to the DOST-MIRDC's streams of initiatives, particularly to the Die and Mold Solution Center (DMSC) that is being put up by the Center by way of research and development. Surface Finishing Technologies are being instituted by the DOST-MIRDC to complement the stages of processes from mold design, prototyping dies and mold, and plastic injection and extrusion. Surface finishing of the extruded materials and components will be the last stage of

Plating Facility for Non-conductive Materials.

the process. Moreover, the project focused on R&D of electroplating various non-conductive materials which are important to the metals and other industries such automotive parts and accessories, furniture and others.

Currently, most of the plated non-conductive materials are manufactured abroad. Locally, the companies performing plating of non-conductive materials are only few and mostly in-house. Our surface finishing capability and expertise are only focused on plating of conductive materials (metals). The local surface finishing industry is looking for a technology that can process non-conductive materials.

Surface finishing of non-conductive materials by metallic coats present challenges in the local industry. The DOST-MIRDC is often asked by the electroplating industry if they have expertise and technologies on plating of non-conductive materials. To assist the local industry on surface finishing and enable them to cater the needs and demands for plating of new materials including engineered plastics, composites, etc., the DOST-MIRDC developed its capability and conducted R&D on plating of various substrate materials.

A series of experimentations was conducted to establish parameters on metallization and plating of non-conductive materials such as ABS plastics, shell, leaves, etc. Aside from visual inspections, the quality of finished products is tested in terms of coating thickness, adhesion and corrosion tests.

As such, this project is in response to the need to develop know-how, expertise, and technology on metallic coating of various substrates including plastics and non-metallic or organic materials.

Techno-Demonstrations of Anodizing Facility.

Samples of plated non-conductive materials.

PROJECT UNDER DOST-GIA

Development of Tent Systems for Emergency Applications

The tent systems provide immediate shelter to people displaced by calamity or disaster. Further, a multipurpose tent serves various functions such as temporary warehouse, field hospitals and command centers. The tent system is designed to enable ease in manufacturing, not just by specialized tent manufacturers but also by those involved in metalworking and garments manufacturing. The tents are basically composed of steel framings and fabric roofing and walls. Its pillars (posts) are made of G.I. pipes. They are cost-effective and durable enough to serve as temporary shelter until such time disaster-stricken people can rebuild and return to their homes. Hence, the availability of cost effective and easily manufactured tents will strengthen the country's capability to respond to emergencies especially when it comes to critical needs for shelters. Stockpiles of these tents can also be setup, ready to be deployed as the need arises. Bamboo can be also used as alternative material since some regions are abundant with bamboo trees, thereby supporting sustainable and eco-friendly development.

Deployment of Tent Systems in Ilocos Norte.

PROJECT UNDER THE DOST-MIRDC CONTRACT RESEARCH

Electa Wear Parts Improvement Project

In 2014, the Electa Tarlac Aggregate Corporation (ETAC) entered into a contract research agreement with the DOST-MIRDC for a project focusing on the improvement of cast wear parts used in its aggregate crushing operations. ETAC, which operates in three (3) local crushing plants located in San Jose and Mayontoc, Tarlac and Dolores, Quezon, is a major producer of five (5) types of construction aggregates: G1, ¾", 3/8", S1 (sand) and base coarse.

The subject of the project is the main consumable wear component in the crushing operations - the austenitic manganese (AMS) steel liner plates. These liner plates are some of the highest value spare parts due to high acquisition cost and long


San Jose Plant, Tarlac.


Mayantoc Plant, Tarlac.

Rock samples from San Jose, Tarlac; Mayantoc, Tarlac; and Dolores, Quezon.

Worn-out austenitic manganese steel jaw crusher liner.

delivery lead times. It was observed that there are inconsistencies between the service lives of imported liners and locally sourced replacements. In some cases, these plates even fail by cracking during service causing an unscheduled plant shutdown which directly translates to unexpected costs. In order to address these issues by improving the value of these parts, several activities were conducted such as (1) characterization of liner casting through metallography and chemical analysis. The qualitative and quantitative analysis of liners may be used as reference to identify the direct effect of the composition of liner on its service life and may be used for establishment of manufacturing and acceptance test parameters. (2) Characterization of rocks that are fed into the crushers based on solid density, crushability, abrasiveness and dust level. The identification of rock characteristics relevant to crushing will establish reference on the possible crushing parameters. Lastly, (3) assessment of local foundries' competency in proper casting of manganese steel liners and development of capability to customize.

Based on the data gathered, a baseline data for performance evaluation and improvement, a standardized purchasing specifications and acceptance criteria and documentations were developed and accepted for implementation by a local foundry. Procedures for failure analysis and a simple delivery acceptance test were developed. Also, proposed improvements in the design of liners including alloy grade, crushing chamber and tooth profile were also considered for implementation.

Liner sample for characterization.

Cutting of sample from a jaw plate.

Technology Diffusion

Everyone at the MIRDC is working toward realizing one vision, and that is to mold the metals, engineering and allied industries into becoming globally competitive. As such, the MIRDC aims to be a center of excellence in science, technology and innovation by 2025. This vision is what glues us all together. Each division of the MIRDC are engaged in different activities and all have varying targets to hit. But the underlying reason why we do what we do is because we want to create a worthwhile impact to the M&E industries and all our stakeholders as well.

Central to all the activities conducted by the MIRDC is the Technology Diffusion Division (TDD). Amidst the fast-paced and ever-changing environment in the world of R&D and S&T services, the stakeholders need to be constantly informed of what is going on – what projects are being implemented, why we are doing such projects, and how they will benefit from these initiatives. Under the TDD are the following sections: Technology Information and Promotion Section (TIPS); Industrial Training Section (ITS); and Technology Advisory and Business Development Section (TABDS) which serves as the fast lane that links the MIRDC to the industry, other government agencies, the academe, existing and potential partners.

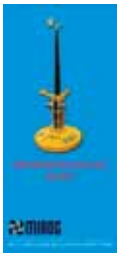
TECHNOLOGY INFORMATION AND PROMOTION

Alongside the endeavors undertaken by the Center, the TIPS makes sure that the MIRDC is able to reach out to its stakeholders. The TIPS is responsible for spearheading activities that will bring the Center within easy reach of the industry. Our perspective is one that is outward-looking. Where there are R&D projects, the TIPS explains. Where there are collaborations with the industry, the TIPS assists. Where there are dialogues, the TIPS facilitates. The TIPS means to do away with the jargon. Our aim is to be nothing less than the industry's appreciation so that we will become a household name.

A. Publications

For 2015, the TIPS led the production of several publications. Among these are the September – December 2014, January – April 2015, and the May - August 2015 issues of the Trends and Events, the official newsletter of the MIRDC. These are distributed to prominent government officials and industry partners. It is circulated nationwide to make the MIRDC's presence felt by even those in the countryside. The TIPS is at the front line in the production of the 2014 Annual Report and Volume 2 of the Philippine Metals (PhilMetals), both were released in June 2015. The said publications featured technologies and services of the MIRDC. The Annual Report is a collection of each of the division's accomplishments for the year based on required Major Final Outputs (MFOs), while the





PhilMetals serves as the Center's vehicle for promoting its R&D initiatives through the publication of relevant technical papers. The PhilMetals features the 'Men in the M&E Industries' section where we highlight the accomplishments and contributions to the industry of a prominent and well-known personality.

Adding more to the list of our publications are the Metal Stamping Sector Study and the M&E Week Souvenir Program. These are registered with ISBN and ISSN, respectively. We see to it that our R&D efforts and scientific and technical services are promoted appropriately by means of these publications.

B. Technology videos

The TIPS did not only concentrate on activities related to publications. We also got support for our technology promotions activities from the technology videos produced by various project teams. 2015 saw the creation of several technology videos. Through the collaborative actions spearheaded by the TIPS, the making of these videos went smoothly, and so did the actual promotional activities where the videos were presented to the potential market and to the public in general. The videos produced in 2015 include the Hybrid Road Train, and food processing equipment, namely: the Spray Dryer, the Vacuum Packaging Machine, the Freeze Dryer, the Vacuum Fryer, and the Water Retort. The videos were done professionally so that the technologies and their corresponding benefits are clearly seen and imparted to the desired audience.

C. Exhibits

The TIPS took the MIRDC-developed technologies to different events nationwide held during the months of June, July, August, and September 2015.

July is always a big month for the entire Department of Science and Technology (DOST) family. All regular and attached agencies of the DOST identify certain technologies to highlight during the National Science and Technology Week (NSTW). This year, the NSTW was held on 24-28 July at the SMX Convention Center, Mall of Asia in Pasay City. The MIRDC is clustered under

South Luzon Cluster (Palawan)

North Luzon Cluster Fair (Vigan)

Visayas Cluster (Ormoc)

Mindanao Cluster (Zamboanga)

Outcome 3: Industry Competitiveness group which is composed of the research and development institutes (RDIs) of the DOST. Adhering to the theme, 'Philippines: A Science Nation Innovating for Global Competitiveness,' the MIRDC brought to this major exhibition the Retrofitted Compact Rice Mill for Brown Rice Production, the Local Microwave Vacuum Dryer, the Superheated Steam Treatment System (SSTS) for Stabilized Brown Rice (Batch-type), the Fluidized Bed Dryer and the Auto Parts Testing Facility. The most imposing technology brought by the MIRDC to the 2015 NSTW, however, is the Hybrid Road Train. The pilot coach of the Light Hybrid Road Train is the centerpiece exhibit of Outcome 3. Outside the SMX, the bigger version of the Hybrid Road Train, all five coaches, was on proud display. It was featured on a public Demo Run for the entire duration of the NSTW. This Demo Run captured the nation's attention. Visitors from all sectors lined up to avail of the free ride on the Hybrid Road Train. We also had aboard some of the most prominent political figures like Sec. Manuel A. Roxas II, Sen. Cynthia A. Villar, and Department of Transportation and Communication (DOTC) Secretary Joseph Emilio A. Abaya. Through the efforts of the TIPS and in coordination with the concerned project teams, display panels, 3D printed models of the equipment, and the huge coaches of the Hybrid Road Train were brought on display and attracted many viewers to gather around the MIRDC booth.

The MIRDC received invitations to participate in quite a number of exhibits. We gladly accommodated these invitations and we had the chance to promote the same technologies to other exhibitions: the Philippine Halal Assembly and International Expo at the Marriot Hotel in June; and the 2015 PDMEx held at the World Trade Center and the APEC at the PICC, both held in August.

Spin-offs of the 2015 NSTW are the regional S&T fairs. The TIPS showcased once again the MIRDC technologies in the regional exhibitions: Puerto Princesa City, Palawan on 17-19 August 2015; Vigan, Ilocos Sur on 1-3 September 2015; Ormoc City, Leyte on 23-25 September 2015; and Zamboanga City on 16-18 November 2015. Industry players, people in the academe, and representatives from the media visited the MIRDC booths. Information-sharing and network building were two of the most important achievements of the TIPS in these regional activities, as these served to catalyze partnerships between the MIRDC and the SMEs, and opened up opportunities for expansion of the industry's market base.

D. TV/Radio Interviews

We are eager to promote our technologies with utmost sincerity and confidence. With the enhancement of the M&E industries' productivity and competitiveness as our motivation, the TIPS linked up with the media who have always been very supportive of our initiatives. In synch with all the promotional activities that the Center engages in are the print, TV, and radio coverage as well as the internet exposures that featured the MIRDC's technologies.

With our determination to be seen and heard everywhere, the TIPS harnessed all possible platforms - live studio interviews in various TV and radio stations, newspaper columns, and online news programs and publicities. The TIPS was in charge of handling correspondences and coordination with the media. Highlighted for full-swing promotions were the Die and Mold Solution Center DMSC) and technologies such as the Hand Tractor, and the Retrofitted Compact Rice Mill. The MIRDC's ISO-accredited laboratories were featured on national TV by the CNN. The technologies which earned the highest number of media coverage and became the most talked about issues were those under the Advanced Transportation Systems Program which includes the Hybrid Road Train, the Automated Guideway Transit (AGT) System, and the Hybrid Electric Train. They continued to make waves until the late part of 2015. The TIPS was behind these successful media exposures.

We found a dependable partner with the media in our aspiration to spread the word about the MIRDC's R&D outputs. As a token of our valued partnership with the media, our media-friends are always part of every activity conducted by the Center. 'Through thick and thin,' they say. The TIPS remains committed to nurture this partnership for continued effective information-sharing.

Mr. Jimmy T. Chan, Governing Council member of the MIRDC, and Mr. Philip C. Ang, President of the PDMA, talk about the DMSC in Net25.

Engr. Florante A. Catalan guests in PTV4 to promote the Auto Parts Testing Facility

Dr. Rio S. Pagtalunan, Chief of the ATD and Project Leader of the Hybrid Road Train project, provides inputs to Mr. Paolo Abrera of the ANC.

E. Assisted/Coordinated events

The TIPS, being the promotional and advertising arm of the MIRDC, makes its services available to all divisions and project teams. As part of an organization that focuses mainly on R&D and provides training services, our role is basically to present the R&D and training outputs and updates to our stakeholders. We need to keep them aware and involved. Hence, the TIPS provides the R&D – industry interface. The various project teams implement the R&D and training activities, and the industry expects to benefit from these initiatives. The role of the TIPS is critical in making technology transfer activities a success. When a project reaches completion, the TIPS is there to facilitate dissemination of information, thus, we bring our R&D, including our technical services closer to where their outputs are most needed.

The MIRDC always has its industry partners in mind in all its undertakings. In 2015, the TIPS organized a number of discussion events: a Focus Group Discussion (FGD) for the project entitled, 'Design and Development of Hand Tractor Attachments' on 9 March 2015; launching of the Retrofitted Compact Rice Mill for Brown Rice Production on 20 August 2015; a validation activity of the Metalcasting Industry Roadmap on 6 October 2015; an FGD on the curriculum development of the Die and Mold Designers and Makers (D2M2) on 27 October 2015; and another FGD on the Competitive Roadmap of the Tool and Die Industry of the Philippines, coupled in the afternoon by the 'PartnerShape

Participants of the Competitiveness Roadmap pose together with other guests.

Dr. Danilo N. Pilar facilitates the FGD on curriculum design of the D2M2.

Engr. Nico Deus O. Villafranca explains the Retrofitted Compact Rice Mill for Brown Rice Production during its launching.

Engr. Rolando A. Jaurigue, the MIRDC Legacy Trophy Awardee.

Conference' on 15 December 2015. Through these discussion sessions, the MIRDC was able to gather inputs from key industry players themselves, inputs that will help the Center offer customized solutions and interventions tailor-fit to the industry's unique needs.

June is specially marked in the calendar of MIRDC employees. This is the Anniversary month of the MIRDC, as well as the celebration of the M&E Week. The TIPS handles various activities for these two major celebrations year after year. The 2015 M&E Week, held on 15-19 June 2015, commenced under the theme, 'MakiBayan 2015: Accelerating Toward a Competitive Auto Parts Manufacturing Industry.' Highlighted in the M&E Conference was the launching of the MIRDC's Auto-parts Testing Facility (ATF) and the signing of MOU between the MIRDC and its newest MakiBayan partners: the Motorcycle Development Program Participants Association (MDPPA), the Motor Vehicle Parts Manufacturers Association of the Philippines (MVPMAP), and the Mechatronics and Robotics Society of the Philippines (MRSP). Another highlight was the conferring of the prestigious MIRDC Legacy Trophy to Engr. Rolando A. Jaurigue who has made great contributions to the achievement of the vision, mission and goals of the MIRDC.

The TIPS was an essential contributor to the event's success playing a supportive steering role on lined-up Center-wide activities. Likewise, the three-day free AGT demo ride, info-seminar featuring the Vacuum Heat Treatment and Surface Engineering/ Anodizing Technology, techno-demo featuring the CAD CAM and CNC milling technologies, and an info-seminar on the 5S Program were all attended to by the TIPS, all the way from planning up to activity wrapping up. The M&E Conference was held on 18 June 2015, and capping off the week was the 49th Founding Anniversary celebration of the MIRDC. The TIPS was there to provide assistance every single step of the way.

The MIRDC is serious in aiming to realize its Corporate Social Responsibility (CSR). This activity is done in consonance with the celebration of the MIRDC's Anniversary to make the event more meaningful. This year, the TIPS spearheaded the fulfillment of the Center's CSR in cooperation with the Daang Hari Elementary School (DES). Careful to attend to all the necessary correspondences, the TIPS helped oversee the fabrication and installation of steel matting frames to be used for the school's vertical garden. This initiative aims to provide the

The steel matting frames used in the vertical garden of the Daang Hari Elementary School, fabricated and installed by the MIRDC.

students and school personnel a cleaner and greener environment that is more conducive for learning.

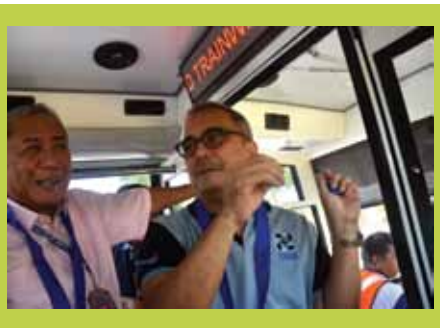
Immediately after the M&E Week, the MIRDC conducted the Hybrid Road Train Media Tour and Demo Ride at the Clark Freeport Zone on 25 June 2015. The TIPS worked in close coordination with the Hybrid Road Train project team under the leadership of Dr. Rio S. Pagtalunan. While the project team focused on the technical aspects, the TIPS devoted time to go over all the other critical details. Combined efforts of all involved personnel resulted to a well-attended demo ride. Together, we were able to successfully present to the media, the industry, and the target beneficiaries of the Hybrid Road Train a healthy partnership between the DOST led by Sec. Mario G. Montejo, the MIRDC led by ASec. Robert O. Dizon, and the Clark Development Corporation led by its President Arthur P. Tugade.

TIPS' assistance helped achieve the objectives of the succeeding activities of the Center in the latter part of 2015. The TIPS was tapped to provide support to the turn-over ceremonies of the emergency tent system prototypes in selected municipalities in Region 2 in September, and to the conduct of the ATF Awareness Seminar on 21 October 2015. The TIPS was also able to successfully juggle preparations needed for the DOST Science Nation Tour/Public AGT Demo Ride and the launching of the SSTS for Stabilized Brown Rice and the Microwave Vacuum Dryer, two promotional events held simultaneously on 9 December 2015.

What we really want to achieve in doing all these activities is for the MIRDC's R&D projects to be understood by the stakeholders. Igniting their understanding creates opportunities that will benefit the M&E industries.

In addition to all these achievements of the TIPS, we are constantly extending our services to stakeholders through the conduct of plant tours and offering of library services. It is through the efforts of the TIPS that the Center was able to accommodate a total of 75 plant visits and 367 library researchers coming from the industry, the government and the academe.

From left to right: ASec. Robert O. Dizon, DOST Sec. Mario G. Montejo, CDC President Arthur P. Tugade and DOST USec. Rowena Cristina L. Guevara during the ribbon-cutting ceremony at the Hybrid Road Train Media Tour and Demo Ride at Clark Freeport Zone.



INDUSTRIAL TRAINING

One of the MIRDC's missions is 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. It is along with this premise that the Industrial Training Section (ITS) promotes its training programs not simply as a matter of instructing people but educating and motivating them to learn better ways of doing things.

A total of 151 training programs were conducted in 2015 for 2,801 participants from 578 firms that generated a total income of P3.6M.

Below is the list of training programs conducted with the corresponding frequency and the number of persons trained for the year:

Summary of Regular Training Programs Conducted in 2015

Title of Training Programs	Frequency of Programs Conducted	No. of Trained Persons
Awareness on ISO 9001:2015	1	15
Awareness on Risk Management	1	11
CNC Milling Programming & Operations	1	5
Developing & Implementing a Laboratory Quality Management System Based on ISO/IEC 17025	1	8
DM 1: Basic Measurement	3	65
DM 2: Basic Length Calibration	4	45
DM 3: ISO Limits & Fits & Insp. Of Geo. Tol	1	10
Electroplating Processes	1	4
Establishment of Preventive Maintenance System	2	34
Fundamentals of Corrosion	1	10
Industrial Calibration	3	73
Internal Quality Audit	1	5
Machine Shop Operations	1	9
Metal Fabrication	1	7
Metals ID & Selection	2	7
Mig Mag Welding on Carbon Steel Plates	1	2
Non-Destructive Testing	1	7
PIMM Programming & Operation	1	4
Production Planning and Control	1	17
Productivity Improvement Through 5S Practice	1	4
Root Cause Analysis	1	11
TIG Welding on Carbon Steel Pipes	1	4
Uncertainty of Measurement	2	25
Verification of Common Lab. Instruments	1	19
TOTAL	**34**	**401**

Summary of Packaged Training Programs Conducted in 2015

Title of Training Programs	Frequency of Programs Conducted	No. of Trained Persons
Awareness on Risk Management	2	34
CNC Milling Programming & Operations	6	80
Cost Estimation for Machining Jobs	1	6
DM 1: Basic Measurement & DM 2: Basic Length Calibration	2	20
Documenting the QMS Based on ISO 9001:2008 Std	5	148
Heat Treatment & Materials Testing	3	45
Heat Treatment of Steels	4	48
Improving the Workplace Through 5S	4	189
Industrial Calibration	2	44
Internal Quality Audit	5	133
ISO 9001:2008 Awareness	14	519
ISO 9001:2015 Awareness	1	15
Machine Shop Operations & General Welding Processes	2	41
Metals ID & Selection	1	13
Plastic Injection Molding Machine Programming & Operation	2	20
Productivity Improvement Through 5S Practice	2	58
Root Cause Analysis	1	20
SMAW	3	55
SMAW & GMAW Welding Processes	1	19
Steel Fabrication & Machine Shop Operations	1	14
Torch Cutting	1	20
Uncertainty of Measurement	1	12
TOTAL	**64**	**1,553**

Below is the regional distribution of the training programs conducted by MIRDC nationwide:

Summary of Regional Training Programs Conducted in 2015

Title of Training Programs	Frequency of Programs Conducted	No. of Trained Persons
5-Axis CNC Machine Tool Programming & Operations	5	30
Basic Welding: Weld Defects, Causes & Preventions	1	20
CNC Machine Tool Proramming & Operations	2	40
CNC Milling Programming & Operations	6	63
CNC Turning Programming & Operations	5	41
Electroplating Processes	3	41
Gemstone Processing	2	57
GMAW on Carbon Steel Plates	1	16
Heat Treatment of Steels	1	18
Information Seminar on 5S Program	1	27
Information Seminar on Establishment of PM System	1	30
Information Seminar on Surface Finishing	1	30
Internal Quality Audit (ISO/IEC 17025)	1	43
Machine Shop Operations	6	55
Material Selection	1	19
Metal Fitting	1	12
Production Planning and Control	2	82
Productivity Improvement Through 5S Practice	1	14
SMAW	6	85
Spincasting	2	13
TIG/MIG Machine Oprtn & Maintenance	1	32
Turning, Facing, Threading & Boring Thru Lathe Machine Operations	1	30
Verification of Common Lab Instruments	1	34
Wrought Iron Forming	1	15
TOTAL	**53**	**847**

Below is the summary of packaged training program by category:

Summary of Packaged Training Programs Conducted in 2015, by Category

TRAINING PROGRAMS	NO. OF PROGRAMS IN THE REGION										
	NCR	CAR	I	III	IV	VII	X	XI	XII	CARAGA	TOTAL
Metalworking Technology	51	2	2	7	3				2	7	74
Analysis & Testing	22		1	1		1	1				26
Engineering, Prodn. & Planning	4				1					2	7
Management/Productivity Improvement	9										9
Others	29			3	2			1			35
TOTAL	**115**	**2**	**3**	**11**	**6**	**1**	**1**	**1**	**2**	**9**	**151**

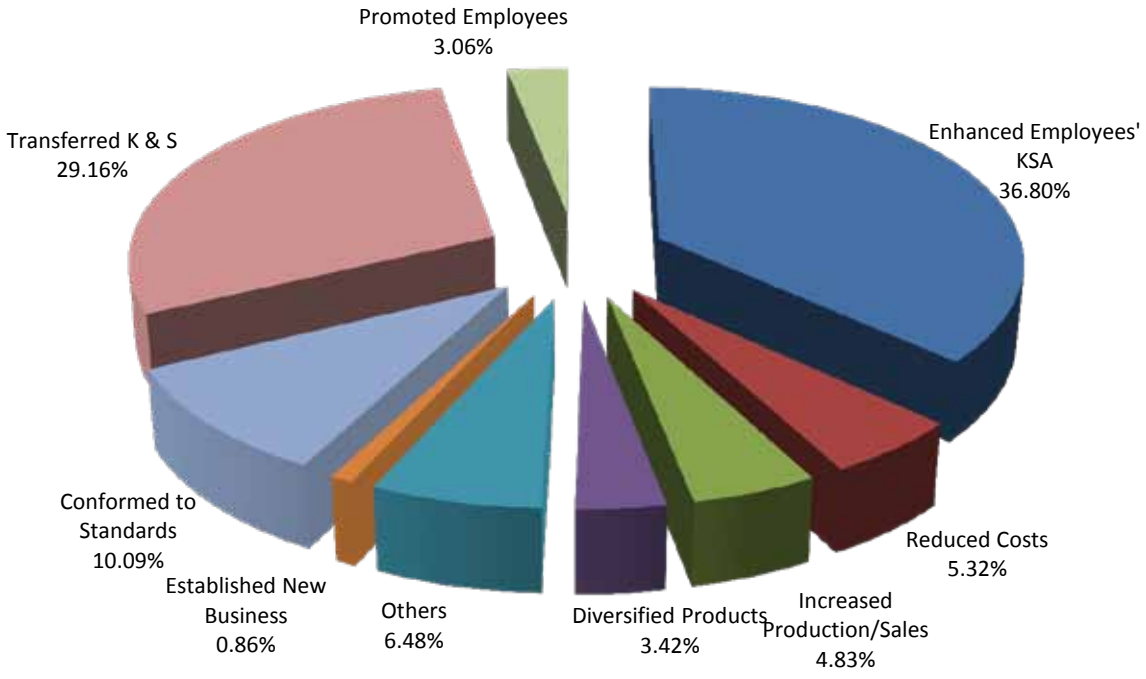
ITS desires to determine the impact/benefits gained by industries hence, an impact assessment is administered six months after the conduct of a training program. The results will serve as a device for continual improvement in terms of the program offerings of the Center as well as in identifying future needs of the industry.

On the right is the tabulated result of the survey from January-December 2015. Two hundred fifteen (215) firms responded during the survey.

Summary of 2015 Impact Assessment Survey

IMPACT/BENEFITS	TOTAL	%
Enhanced Employees' KSA	602	36.80%
Reduced Costs	87	5.32%
Increased Production/Sales	79	4.83%
Diversified Products	56	3.42%
Others	106	6.48%
Established New Business	14	0.86%
Conformed to Standards	165	10.09%
Transferred K & S	477	29.16%
Promoted Employees	50	3.06%
Total	**1,636**	**100.00%**

Result of the Impact Assessment Survey of Training Programs Conducted in 2015



Highlights of Training Programs

- In support to the initiatives of the Technical Education and Skills Development Authority (TESDA), the Heat Treatment and Material Testing for Trainers of the Technical and Vocational Training Corporation (TVTC) of Saudi Arabia was conducted in 3 batches on various dates: October 5-16, 2015 (Batch 1), October 19-30, 2015 (Batch 2) and November 2-13, 2015 (Batch 3).

Class picture of TVTC - BATCH 1 with Training Coordinator Jocelyn Dime (leftmost).

MIRDC's Heat Treatment Facility were introduced by Engr. Tumibay to TVTC -BATCH 2.

Opening Ceremony of TVTC - BATCH 3 held on November 2, 2015 at TESDA.

Hands-on activity on Heat Treatment Laboratory assisted by Engr. Joey Pangilinan.

TVTC participants during the industry/facility tour at Penta Technological Products, Inc. on November 12, 2015.

Closing Ceremony of Heat Treatment and Material Testing for Trainers of the Technical and Vocational Training Corporation (TVTC) held on November 13, 2015 at TESDA.

- Industrial Calibration Seminar - University of the Philippines – Manila conducted on September 24-25, 2015

Actual demonstration of calibration by Engr. Joel B. Bañares, Jr.

Engr. Paul Danniel P. Aquino lectures on temperature calibration.

- DM1: Basic Measurement and DM2: Basic Length Calibration, Philippine Die and Mold Association (PDMA), Batch 1, conducted on August 5-8, 2015

1st day lecture by Engr. Rommel N. Coroña.

Mr. Eduardo V. Diasanta, Jr. and Mr. Ronilo C. Sanchez assist the participants in the hands-on activity.

- CNC Milling Programming & Operations – Southern Luzon State University (SLSU) – Batch 1 – conducted March 2-4, 2015

Participants of CNC Milling Programming & Operations from Southern Luzon State University with Ms. Ma. Elena G. Gurimbao.

- Internal Quality Audit – DOST Central Office – conducted June 23-24, 2015

- CNC Milling Programming and Operations for Professors, Dean and faculty of Cagayan State University, conducted on May 27-29, 2015

Dr. Danilo N. Pilar during the Internal Quality Audit Seminar for DOST-Central Office.

Mr. Augusto S. Atanacio Jr. acts as the speaker for the CNC Milling Programming and Operations.

DOST-Central Office participants for Internal Quality Audit.

Hands-on training of the participants of Cagayan State University.

PROJECT INVOLVEMENT OF ITS

One of the projects that ITS is involved in is the project entitled "Technoville Skills Upgrading Program: Upgrading the Welding Skills of Selected Residents of Barangay 201, Pasay City." The project served as a venue wherein the MIRDC training programs were provided to our fellow Filipinos not only to those who are employed and have the funds, but also to the unemployed ones in Metro Manila barangays. The general objective of the project is to improve the technical trade skills of selected residents of Barangay 201, Pasay City and improve their opportunities for employment and earn better compensation packages.

This project is funded by the DOST-NCR Grant-In-Aid with a total amount of Two Hundred Forty Five Thousand pesos (Php245,000) with a project duration from March to November 2015. The training programs were conducted in July 2015 in the field of Metal Fitting with twelve (12) participants; and Shielded Metal Arc Welding with eleven (11) participants for Batch 1 and ten (10) participants for Batch 2 in August to September 2015.

After the conduct of the training programs, participants took the corresponding assessments based on industry standard facilitated by the Philippine Welding Society (PWS).

Out of eighteen (18) welders assessed for SMAW NC I, fifteen (15) passed the assessment. This National Certification earned by the trainees will serve as one of their credentials to be employed locally and abroad.

Engr. Reynaldo L. Dela Cruz, Jr. discusses topics about Metal Fitting, July 21 – 24, 2015.

Metal Fitting Seminar participants' during their hands-on with Engr. Reynaldo L. Dela Cruz, Jr.

One of the participants of Shielded Metal Arc Welding Seminar (B1) working on his workpiece, August 3-7 to August 11-14, 2015.

Shielded Metal Arc Welding (B2) participants enjoy welding their metal specimen, August 3-7 to August 11-14, 2015.

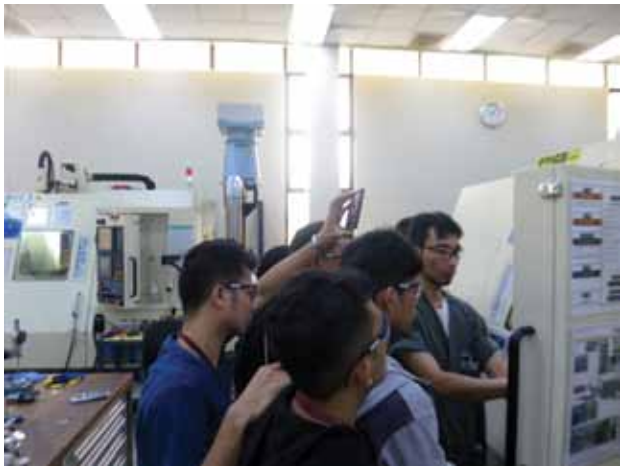
Result of the Assessment Conducted by PWS

No. per Batch	Date	Welding Process	Total No. of Welders Tested	Passed	Failed
Batch 1	10-Sep-15	SMAW NC I	15 Welders	13	2
Batch 2	10-Oct-15	SMAW NC I	3 Welders	2	1
			18 Welders	**15**	**3**

CNC PROJECT

The CNC Project which is entitled, "Human Resource Intervention for Sustainable Growth and Competitiveness of the Metals and Engineering Sector: Development and Implementation of Appropriate Training Curriculum Design for CNC Machine Tool Programming and Operations" aims to develop an appropriate training curriculum design aligned to the goal of effectively developing a pool of skilled CNC programmers and operators whose acquired knowledge and skills match the requirements of the metalworking sector.

The domestic metals and engineering (M&E) industries are experiencing productivity problems due to the apparent lack of competent workforce especially CNC programmers and operators. The continuous exodus of skilled CNC workforce for high-paying jobs abroad has added to the manpower problem of the metalworking sector. The situation is further aggravated by the mismatch of acquired CNC skills against the requirements of the sector. Recognizing these twin problems, the DOST through the MIRDC took the initiative, with the help of partner support organizations (PSOs) both public and private, to address the situation in order to improve the productivity and competitiveness of the M&E sector.








Starting the year with only four training venues (MIRDC and three TESDA RTCs), additional RTCs were tapped expanding the number of training venues to eight. The new additions include TESDA RTCs New Lucena (in Iloilo), Cebu City, Davao City and Taguig City. Thus, recruitment efforts were intensified in the regions with the assistance of concerned DOST Regional Offices and MIAP local chapters.

The summary of trainee-graduates under Year 3 (2015) is summarized as follows:

LOCATION/BATCH	DURATION	NO. OF GRADUATES
MIRDC		
Batch 7	Nov. 18, 2013 - Feb. 28, 2014	20
Batch 8	January 15 - April 23, 2014	20
Batch 9	February 27 - May 30, 2014	20
Batch 10	March 20 - June 23, 2014	20
Batch 11	April 28 - July 25, 2014	20
Batch 12	May 23 - August 27, 2014	20
Batch 13	August 18 - Nov. 14, 2014	20
Sub-total		**140**
SOM – CAVITE		
Batch 1	July 7 - October 4, 2014	20
Batch 2	July 30 - October 31, 2014	20
Batch 3	August 29 - Dec. 10, 2014	20
Sub-total		**60**
CAR		
Batch 3	Sept. 23, 2013 - Feb. 10, 2014	20
Batch 4	Nov. 26, 2013 – Mar. 14, 2014	20
Batch 5	May 28 - August 29, 2014	20
Batch 6	July 21 - October 10, 2014	20
Batch 7	Sept. 16 - Dec. 12, 2014	22
Sub-total		**102**
LA UNION (DMMMSU)		
Batch 1	May 28 - August 22, 2014	20
Batch 2	July 30 - October 31, 2014	17
Sub-total		**37**
BATANGAS		
Batch 2	March 17 - June 24, 2014	14
Batch 3	May 26 - August 27, 2014	19
Sub-total		**33**
ILOILO		
Batch 1	January 8 - April 4, 2014	20
Batch 2	April 28 - July 18, 2014	20
Batch 3	June 30 - Sept. 19, 2014	20
Batch 4	August 19 - Nov. 7, 2014	21
Sub-total		**81**
TALISAY		
Batch 2	February 12 - May 26, 2014	20
Batch 3	March 25 - June 23, 2014	20
Batch 4	May 26 - August 15, 2014	20
Batch 5	Sept. 24 - Dec. 12, 2014	20
Sub-total		**80**
CEBU		
Batch 1	Dec. 3, 2013 - April 14, 2014	20
Batch 2	April 29 - August 4, 2014	20
Batch 3	June 17 - Sept. 22, 2014	20
Batch 4	Sept. 2 - Dec. 5, 2014	20
Sub-total		**80**
DAVAO		
Batch 1	March 28 - June 27, 2014	20
Batch 2	June 27 - Sept. 26, 2014	19
Sub-total		**39**
TOTAL		**652**

The summary of trainee-graduates during the extension period is summarized as follows:

LOCATION/BATCH	DURATION	NO. OF GRADUATES
MIRDC (3-axis)		
Batch 14	Jan. 28, 2015 – April 27, 2015	20
Batch 15	Mar. 10, 2015 – June 22, 2015	21
TOTAL		**41**
MIRDC (5-axis)		
Batch 1	April 28 – June 17, 2015	5
Batch 2	June 8 – July 27, 2015	6
Batch 3	Sept. 2 – Oct. 20, 2015	8
Batch 4	October 20 – Dec. 15, 2015	6
Batch 5	October 22 – Dec. 17, 2015	5
TOTAL		**30**
MIRDC (Special Training)		
Batch 1 (TUP)	October 5 – 23, 2015	9
Batch 2 (PUP)	October 12 – 30, 2015	8
Batch 3 (PUP)	October 19 – Nov. 6, 2015	8
Batch 4 (TCU)	October 26 – Nov. 13, 2015	8
Batch 5 (TCU)	November 2 – 27, 2015	8
TOTAL		**41**

Overall, the actual accomplishment as against the target number of trainee-graduates) is shown below:

YEAR	TRAINING PROGRAM	TARGET (No. of Graduates)	ACTUAL (No. of Graduates)
YEAR 1* (2012)	3-axis CNC	-	-
YEAR 2 (2013)	3-axis CNC	400	200
YEAR 3 (2014)	3-axis CNC	600	652
EXTENSION (2015)	3-axis CNC 5-axis CNC Special Training	40 30 40	41 30 41

At the time the project ended in December 2015, a combined total of 964 trainee-participants graduated from the CNC Training Program – 893 for 3-axis (target: 840 pax), 30 for 5-axis (target: 30 pax) and 41 for Special Training Program (target: 40 pax).

Overall, the MIRDC CNC Training Project Team successfully attained the mandated targets of the project. As mentioned earlier, the CNC Training Project Team did well in going out its way to identify potential PSOs recognizing that such effort will contribute much in the achievement of project objectives. Likewise, the strong support of industry associations and Partner Support Organizations substantially contributed to the success of this worthwhile endeavor of the DOST.

TECHNOLOGY ADVISORY AND BUSINESS DEVELOPMENT

Technology Transfer

The Technology Advisory and Business Development Section (TABDS)'s technology transfer activities are designed to disseminate the Center's research and development (R&D) results and other metal sector-related technologies to industry and other interested parties through the conduct of technical consultancies and trainings.

During the year in review, an improvement in the technology transfer process was incorporated by TABDS such as the establishment of the Technology Review Committee (TRC) which assesses new technologies developed by the R&D divisions and provides recommendations as to the modes of protection for the R&D outputs. The TRC consists of members from the TDD-TABDS, OED, PD and MPRD. The recently approved technologies for packaging and transfer are: (a) Micro Cupola for Foundry Research, Instruction and Small Novelty Item Casting Production, (b) Earthquake Simulator/ Shaking Table, and (c) Rotary Press.

Intellectual Property (IP) Management

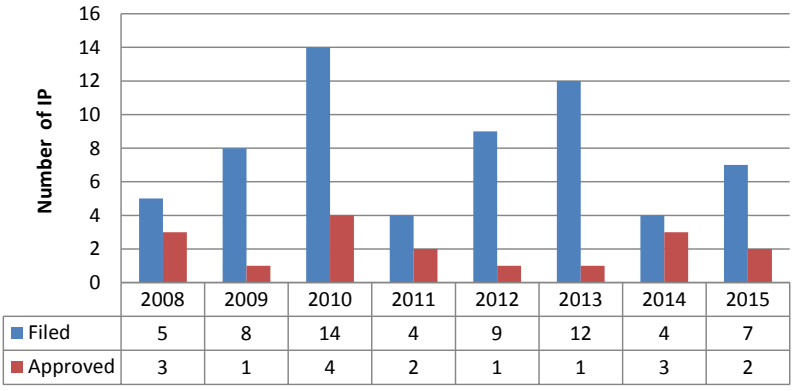
Intellectual property is making noise in the financial revenues or assets of a company today. Being a research and development agency, MIRDC researchers are now being encouraged to document the nobility of their inventive minds as early as the conceptualization stage up to the final design, and eventually IP application.

The Technology Licensing Office (TLO) of the Center is created to manage the IP and give guidance to research teams. IP is very important for TABDS in honoring inventors' contribution to the project since this is part of the conditions for licensing agreement for commercialization. It was in 2015 that the TLO started to manage the IP being produced by the Center in accordance with the newly approved DOST IP Policy (DOST Administrative Order No. 004). TLO is planning to enhance its assistance or guidance to increase the number of IP of the Center, be it in the invention, utility model, trademark, or innovation in processing.

Currently, there are three (3) IP application assisted by TABDS/TLO through the intervention of DOST-TAPI and the PD-DS has four (4) more applications in the pipeline.

MIRDC Technologies with IP Application

Title of IP	TYPE
Water Removal Through Freeze Drying	Invention
Toggle Belt Tensioner	Invention
Double-acting Ratchet-Scissors Type Lifter	Invention
Test-Tube RAC Agitator	Invention
Transplanter Attachment for Hand Tractor	UM
Wrought Iron Forming Equipment	UM
Five-Coach Centrally Powered Road Train Unit	UM
An Automated Guide-Way Transit System (AGT)	UM



	2008	2009	2010	2011	2012	2013	2014	2015
Filed	5	8	14	4	9	12	4	7
Approved	3	1	4	2	1	1	3	2

Summary of MIRDC IP Filed vs. Granted

Establishment of Common Service Facility (CSF) in CAR

One of the objectives of the Capacity Building for Competitiveness of the Metals and Engineering Industry Cluster (CAIMTEC) project of the DOST through the MIRDC is to improve the productivity and competitiveness in the localization of industrial and high precision technology parts of machine shops and other metals and engineering (M&E) firms in the Cordillera Administrative Region (CAR). In fulfilment of this objective, the MIRDC in cooperation with the DOST-CAR and Benguet State University (BSU) established the Common Service Facility (CSF) known as the DOST-BSU-METALS (Metals and Engineering for Training and Local Industries Support). This facility will give access to advanced manufacturing technologies and enable the M&E firms to engage in the production of high-technology parts, agricultural machinery and parts, food processing equipment, and possible requirements of the semiconductor industries.

Two (2) Computer Numerically Controlled (CNC) machines for turning and milling operations, various tools and auxiliary equipment were delivered upon completion of the space allotted by BSU in the College of Engineering and Agricultural Technology (CEAT) Building in La Trinidad, Benguet. The machines were duly commissioned and ensured that all its controls and features are properly working. Other accessories, such as measuring instruments and tools were provided prior to the demonstration of the units. The MIRDC experts conducted information seminar to demonstrate to BSU staffs on how to operate the CNC machines and perform basic troubleshooting.

The successful launching of the CFS was held during the conduct of the Science Nation Tour in the Cordillera Administrative Region (CAR) held last October 7-9, 2015 with the DOST Secretary, Engr. Mario G. Montejo, and various stakeholders.

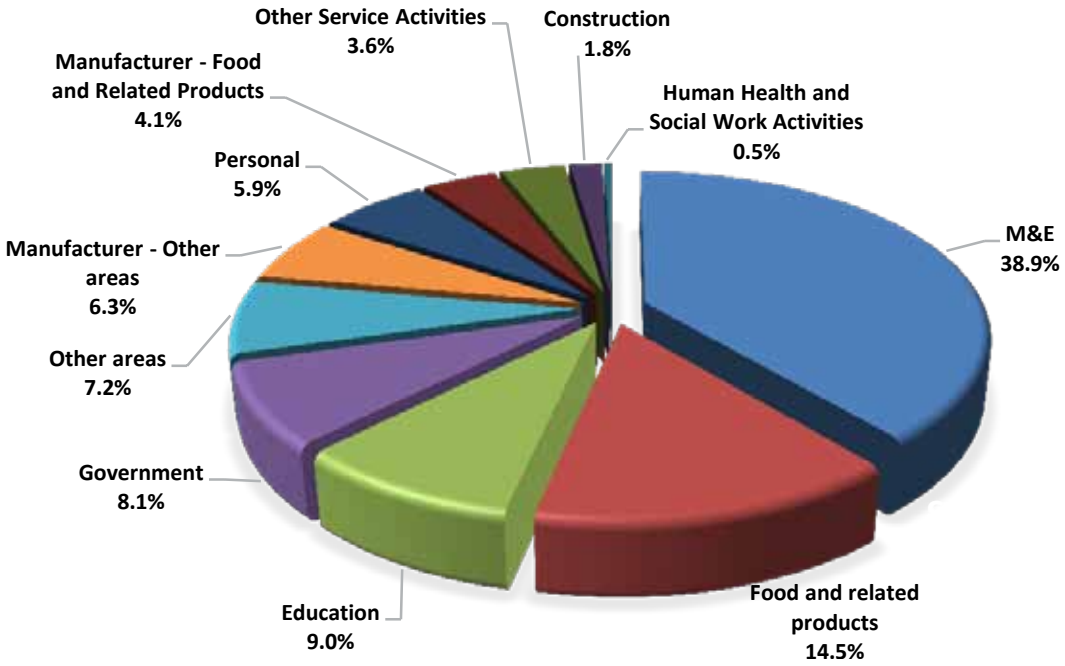
The Launching of Common Service Facility (CSF) in October 2015 at Benguet State University.

Technical Consultancy

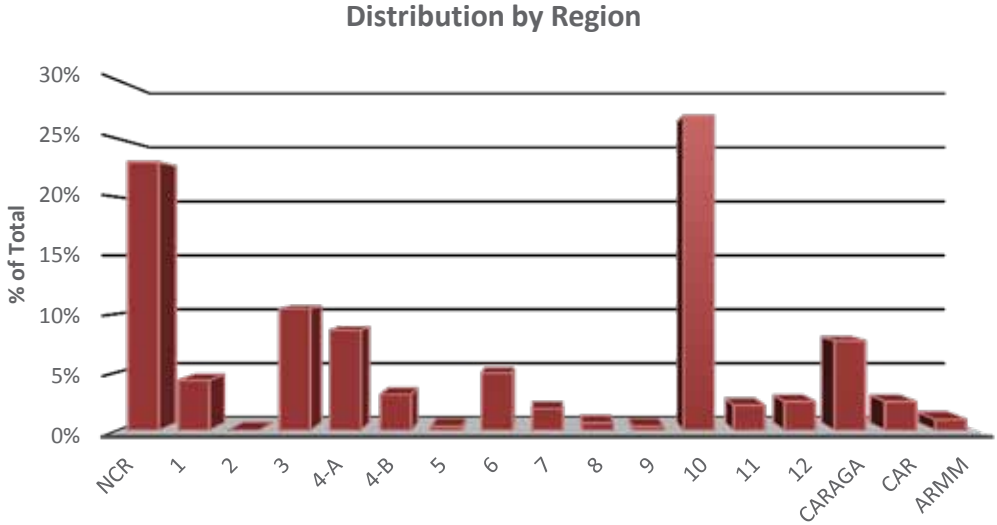
A total of three hundred twenty six (326) technical consultancy services to two hundred seventy two (272) individuals, organizations and offices were provided by the Center's consultants, mainly through its TABDS.

Various consultancy services availed to individuals and firms nationwide addressed their concerns on heat treatment, welding, fabrication, metalcasting, metalworking processes, testing and analysis, calibration, coco-coir technology, muscovado processing/equipment, electroplating, establishment and implementation of a Quality Management System based on international standards and productivity improvement, among others.

Breakdown of the sectors served through technical consultancy are as follows:



2015 Summary of Sectors Served



Stakeholder's Forum - Malaybalay, Cagayan de Oro.

Muscovado Processing, Visayas Cluster S&T Fair 2015.

Consultancy – F. S. Serafica, Ormoc City.

Consultancy - GEMCOR.

Consultancy – RCEM Food Machinery.

TNA/Consultancy - Primark.

A. Establishment and Maintenance of a Quality Management System (QMS) Based on ISO 9001:2008 Standard

Over the years, an increasing number of government institutions and private firms recognized the importance and benefits that will be gained in meeting ISO QMS requirements and getting certified to the ISO 9001:2008 standard. In 2015, six (6) agencies, namely: DOST-Central Office, DOST-PAGASA Weather Division, PHilMech, DOST-Science Education Institute, DOST-Science & Technology Information Institute and National Commission on Indigenous Peoples (NCIP) under the Office of the President entered into a contract for the assistance on the establishment of their QMS.

Among the above agencies which started their QMS documentation and implementation in 2015, the DOST-PAGASA Weather Division is the

only agency which successfully acquired its ISO 9001:2008 certification on October 25, 2015 which is also part of their compliance to the requirements of the World Meteorological Organization (WMO). The TDD-TABDS earned another distinction by providing quality consultancy service on ISO 9001:2008 to this very dynamic and most popular DOST agency in the country and the sole provider of meteorological products and services to both local and international communities.

PAGASA-WD Chief Esperanza O. Cayanan (1st row, 3rd from the right) together with her team was congratulated by MIRDC consultants Linda G. Rivera (2nd row, 1st from right) & Mervin B. Gorospe (2nd row, 2nd from left).

Conduct of ISO-related consultancy services to PAGASA-WD.

Below are the organizations that availed of ISO 9001:2008 consultancies of TABDS.

2015 ISO 9001:2008 Consultancy Services Provided

Table 2: 2015 ISO 9001:2008 Consultancy Services Provided

Type of Consultancy*	Organization	Implementation Date	Completion Date/Status
Maintenance	NCR – Supercast Foundry, Valenzuela City	January	
Establishment	NCR – PAGASA-DOST, Quezon City	February	Oct. 25, 2015 / Certified
Maintenance & Technical	Region VI – RU Foundry, Negros Occidental	March August	Mar. 2015/Re-certified Aug. 2015
Establishment	NCR – DOST-CO, Taguig City	May	On-going
Technical	NCR – SEI-DOST, Taguig City	June	On-going
Technical	NCR – Sanford Foundry, Paranaque City	August	Aug. 2015/Re-certified
Establishment	Region III – PHilMech, Nueva Ecija	August	On-going
Technical	NCR – STII-DOST*, Taguig City	November	On-going
Maintenance	Region VII – PERT, Cebu City	December	Dec. 2015/Re-certified
Establishment	NCR – NCIP, Quezon City	November	On-going

**Establishment – new organization who intends to acquire certification*

Maintenance – ISO certified organization, may or may not be under MIRDC establishment consultancy on QMS establishment

Technical – An organization which availed of ISO-related consultancy

B. 5S Assessment in All Offices of DOST-Central Office

One of the objectives of the DOST – Central Office (DOST–CO) for the year 2015 is to further boost the delivery of its services through the establishment and implementation of 5S and Quality Management System (QMS) based on ISO 9001:2008 Standard. Thus, the DOST–CO tapped the MIRDC for the provision of technical assistance/guidance in the establishment and implementation of an organized workplace and records management, and QMS.

As an initial activity, a 5S assessment/audit was conducted in all offices of DOST–CO on **March 10 & 11, 2015** by the MIRDC 5S Team headed by its Technology Diffusion Division (TDD) Chief, Dr. Danilo N. Pilar. Recommendations were provided to further improve the safekeeping and retention of records, organization of offices and work areas, etc.

Dr. Danilo N. Pilar, TDD Chief, reports the results of the 5S Assessment at DOST-CO conducted by the MIRDC 5S Team.

Analysis & Testing

Raising the Standards

The year 2015 sets another feat that the Analysis and Testing Division (ATD) is truly dedicated to – exceeding targets. The division served a total of 5,050 job orders, that corresponds to 20,993 samples. An achievement that is way beyond the division's target. 140% increase in job orders and 145% in job samples. Let us take a closer look at the division's conquest.

PHYSICAL LABORATORY SECTION (PLS)

Mechanical Metallurgy Laboratory (MML) - If there is an epitome of dedication and perseverance for laboratories, the MML has astoundingly showcased it with exceptional commitment. The laboratory has always overachieved over the past years and this year was something we cannot help to take notice of. The MML rendered over 157% of its original target while doing extra-curricular works specifically with the newest facility of the division – the Automotive Testing Facility. The MML has provided continued support for students in harnessing their knowledge and skills in the field of their interests. One good example is the students from UE College of Dentistry. Brace Brackets for Tooth Braces were tested to determine the maximum force of the adhesive used. Another student from Bansud High School in Mindoro submitted a sample to determine the hardness and the maximum force it can withstand. His invention could be an alternative for bearing puller which is very useful for mechanics and for industries such as automotive, power plants and the like. With people clamouring for better commuting transport, the MRT Management sought the assistance of the laboratory in determining the hardness of the old/used rails, new rail, and the steel wheel of the MRT train.

Non-Destructive Testing Laboratory (NDT) - provides continuous support to the agency's Advance Transport Program. The laboratory tested 88 samples for the Hybrid Electric Train Project, 200 samples for the Automated Guideway Transit Project and 582 samples for the Hybrid Road Train Project which totalled to 870 samples. The laboratory has several interesting samples including Pelton Turbines which will be installed in local hydro-

NDT personnel ANPilar, JABCabarloc and AYVPacia check the weld area and measure the thickness of a boiler in a chemical plant.

electric powerplants to meet the increasing power demand of the country. The rudder stock tested from Rouvia Road Yacht Design is an example, not only of the government's competitive pricing services, but also of the agency's commitment to be recognized even by international maritime classification society. Propeller blades for aircraft were also tested to determine the efficiency of the newly designed bearing seats in if it can withstanding the stress induced by the load it will carry.

Auto-parts Testing Facility (ATF) - Spearheaded by the PLS Group, the much-anticipated launching of the MIRDC's **Auto-parts Testing Facility (ATF)** was held on 18 June 2015 aimed to enhance the competitiveness of automotive parts and components manufacturers. The Philippine roadmap for the automotive parts and motorcycle manufacturing industry identified DOST-MIRDC in establishing common facilities. Highlighted in the CLRV study conducted by PCIEERD in 2011-2013 entitled, Benchmarking with Thailand's "Master Plan for Automotive Industry 2012–2016," is Executive Order No. 182 "Providing for a Comprehensive Automotive Resurgence Strategy Program."

Included in the ATF is the Universal Testing Machine (UTM), an electro-mechanical type with a capacity of 200 tons and with the longest travel stroke (1200 mm) for metal testing equipment. It has an interchangeable 1 ton load cell, the reason why its range of load measurement is extended. An automatic extensometer up to the specimen failure ensures accurate measurement up to failure. Additional width reduction strain measurement makes this UTM able to determine the formability properties of the material under test (r-values & n-values).

Friction materials are also the most important part of the brake and clutch system. The friction testing machine can establish the coefficient of friction that relates to the effectiveness of the material and the rate of wear while performing its function.

Launching of the Auto-parts Testing Facility (ATF).

Engr. Florante A. Catalan introduces the ATF to the guests during its launching.

Engrs. Catalan and Pacia (center) with other participants in the Vibration Test Management System Training on Automotive Testing Facility.

The transport Body Impact Tester is an Impact simulation machine using a pendulum for the structural integrity assessment of automotive structures. Monitoring sensors are attached to the sample such as strain gauges and accelerometer while a high-speed camera captures the moment of impact for further analysis.

Engrs. Florante A. Catalan and Arvin Yan V. Pacia attended the Vibration Test Management System Training on Automotive Testing Facility in Japan which was conducted by Mr. Shusuke Omiya and Mr. Kayama Toru under Shinken. One of the vital parts of the Automotive Testing Facility is the Vibration Tester that provides multi-axis electro-dynamic vibration simulation. One of its many purposes, the endurance test ensures newly designed products such as automobile, electronic devices and aerospace parts can survive a substantial lifespan that fully operates satisfactorily against stress-induced applications. This equipment can also simulate the vibration induced by transporting products during shipment where the product will be installed or used. With this, the supplier especially the end-user will be confidently assured that the product has outstanding quality.

Establishment of the durability of the tires can be done using the Tire Endurance Tester. Actual load simulation on the tire is applied during testing. Wear rate can be determined and the tire can even be tested up to failure using this equipment.

The ATF includes a Data Recorder/Analyzer using different sensors such as accelerometer, load cells, strain gauges and torque transducer. This can be used either in the laboratory or inside the vehicle while in operation. This equipment was used to measure the vibration inside the vehicle during the travel of the Hybrid Electric Road Train from Clark Angeles City, Pampanga to SM Mall of Asia in Pasay City in preparation for the 2015 Annual National Science and Technology Week. It demonstrates the promising capability of the equipment in the foreseeable future.

MIRDC AUTO-PARTS TESTING FACILITY (MIRDC – ATF) LOGO DESCRIPTION

PLANETARY GEAR INSIDE A PNEUMATIC TIRE

PARTS MEANING:

1. SUN GEAR
- Symbolizes the automotive manufacturers and assemblers in the country.

2. PLANETARY GEAR
- Represents the auto-parts manufacturers in the Philippines directly supporting the automotive manufacturers/assemblers for the local content of their products
- The three planetary gear stands for the three major islands in the Philippines. Through this program, we are hopeful that the local auto-parts industries in Luzon, Visayas and soon in Mindanao be more developed.

3. RING GEAR
- Embodies the MIRDC – ATF to support the local auto-parts manufacturers in order to achieve reliable products and within the quality required by the automotive manufacturers/assemblers.

4. CARRIER
- DOST flagship programs directly supporting the automotive industry in the country.

5. COLOR
- Colors Red, Yellow and Blue symbolize the colors of our National Flag. This represents the identity of the automotive industry.

6. TIRE
- Tire is the only automotive part that is in-contact with the road. The tires take the whole vehicle to the place of destination. The circular shape of a tire represents a continuous rotation towards innovation and improvement. The tire signifies that through the harmonized automotive industry, we will reach our goal to be the next automotive hub in the ASEAN region.

PHYSICO – CHEMICAL LABORATORIES SECTION (PCLS)

The Physico – Chemical and Corrosion Laboratories tested and analyzed a total of 1,821 samples this year. The laboratories acquired new testing capabilities such as X-ray Fluorescence (XRF) for chemical analysis of metals and Cyclic Corrosion Testing. A new PAB-approved scope has been added to the PCLS's services – Chemical Analysis of Aluminum using Optical Emission Spectrometer firmly demonstrating its dedication for maintaining the regulatory requirements of the Department of Trade and Industry-Bureau of Product Standards (DTI-BPS).

In line with the new capabilities, Mr. Lito I. Dimaculangan and Mr. Morris DR. Pioquinto were trained in operating the Thermo Scientific NITON XL3t GOLDD+ XRF Analyzer in Hongkong and attended the Environmental, Health and Safety Seminar for regulation update and compliance. The XRF, which employs non-destructive technique, also facilitates the conduct of field or on-site testing for chemical analysis.

Cognizant of the need for additional personnel, Ms. Jo Marie Venus T. Agad, a registered chemist, was hired this year as Senior Science Research Specialist and was designated as the Unit Head of the Physico-Chemical Laboratory.

Mr. Morris DR. Pioquinto (above) and Mr. Lito I. Dimaculangan operate the Thermo Scientific NITON XL3t GOLDD+ XRF Analyzer in Hongkong.

Engr. Gina A. Catalan (3rd from left) during the plant visit in AISIB, Malaysia accompanied by its Operation Manager, Engr. MohdShakri.

Meanwhile, Engr. Gina A. Catalan attended on March 3, 2015 the seminar on "Vehicle Type Approval Testing" at Standards and Industrial Research Institute of Malaysia (SIRIM), a government agency analogous to DOST. The highlights of the seminar include Malaysia's Vehicle Type Approval (VTA) system, laboratory tour and plant visits in Proton showroom and Automotive Industries SDN Bhd. (AISB) and MajuSaintifik SDN Bhd.

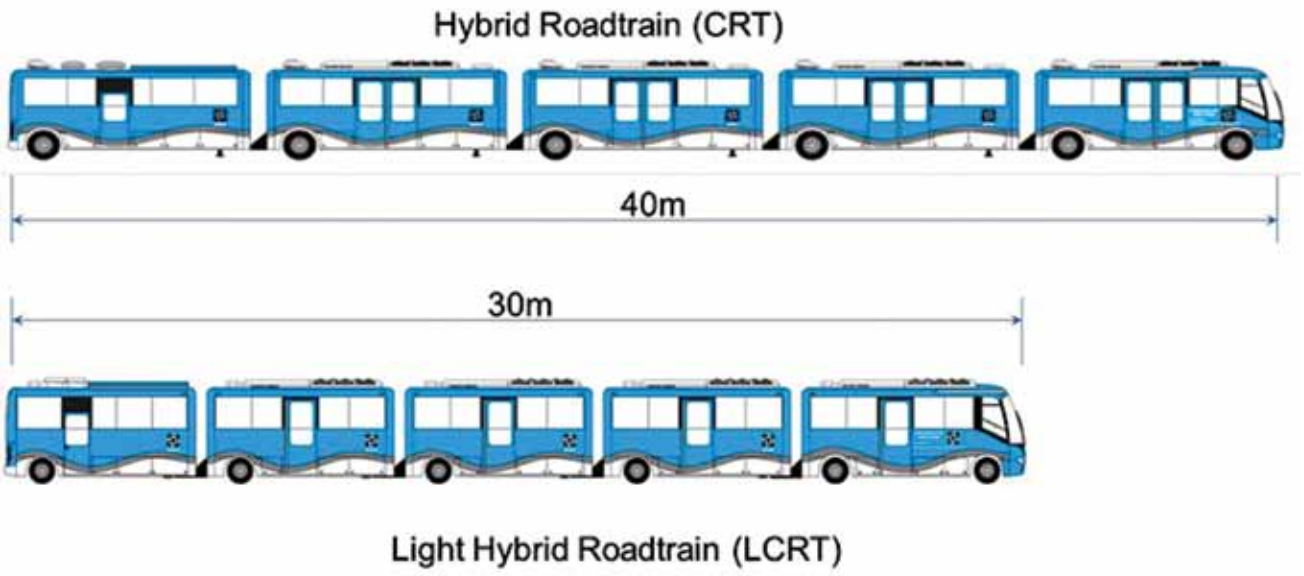
Engr. Catalan applied for Pollution Control Officer (PCO) Accreditation at the Environmental Management Bureau (EMB) of DENR. As a requirement for this, Engr. Catalan and Ms. Agad attended the 40-hour seminar on "Basic (PCO) Training Course" provided by the Environmental Counselors, Inc. in Ortigas, Pasig.

INSTRUMENTATION AND METROLOGY SECTION (IMS)

For the Instrumentation and Metrology Section, the year 2015 is one for the books. The laboratory recorded the highest total income and total number of jobs in the history of its existence. The section served 1,025 companies with a total of 2,285 jobs generating a whopping 13.3 M peso income. IMS' model employee, Mr. Samuel A. Ysit, was sent to India for training in Industrial Electronics and Instrumentation. Resource Speakers from the Indian Institute for Production Management Kansbahal,

Development of LCRT.

Ticketing System Installation of CRT.



Odisha discussed topics on Maintenance Concepts, Strategies and Planning, Power system, Instrumentation and Sensors, Digital Electronics, Robotics, Data Acquisition, Microprocessor, PLC, SCADA and Computer Based Maintenance Management System. The training enhances the MIRDC's capability in providing technical consultancy to the M&E industries.

The Philippine Accreditation Bureau now includes newly approved calibration signatories: Mr. Myro Jon M. Barona for mechanical balances, ultrasonic testing machine and pressure gauges and Engr. Charles Edward L. Alviar for small tools for engineering and dimensional metrology.

IMS staff Engrs. Rommel N. Coroña, Arlene G. Estacio and Christian M. Ibanez were also involved in the deployment of the Hybrid Electric Road Train and Light CRT. The performance testing primarily determines if the vehicles are roadworthy. A standard protocol program was followed to determine the Hybrid Road Train's mechanical and electrical functionality. Also installed in the CRT is the ticketing system that will regulate and monitor the passengers on-board. The same system can be seen in the current version of beep cards utilized by our train systems (i.e. MRT & LRT).

With the increasing demand for mass transportation, the public has seen the road train's feasibility to accommodate the needs of the many. The Cebu public sector, for example, has agreed to incorporate the road train in their plan for bus rapid transit system. On May 6, 2015, the City Government of Cebu represented by Honorable Mayor Michael L. Rama and the DOST-MIRDC represented by Secretary Mario G. Montejo, Dr. Rio S. Pagtalunan and Atty. Trixie Hazel C. Veluz signed a Memorandum of Understanding (MOU). Meanwhile on September 22, 2015, the Clark Development Corporation (CDC) represented by its President, Atty. Arthur P. Tugade, and DOST-MIRDC represented by Asec. Robert O. Dizon signed a Memorandum of Agreement (MOA) to use the Light Road Train to ferry people in and out of CDC.

Road Train Team and NDT Personnel preparation during the travel of the CRT from Clark to SMX Mall of Asia for the NSTW.

MOU Signing of CRT in Cebu City by Mayor Michael L. Rama and DOST Secretary Mario G. Montejo on May 6, 2015.

MOA Signing of LCRT at Clark, Pampanga with CDC President Arthur P. Tugade and MIRDC OIC Robert O. Dizon.

Consistency

With all these achievements and success, the laboratory has always complied with its ISO/IEC 17025:2005 accreditation. The division is constantly improving its ways and means to be more productive yet efficient in testing and calibration. The Agency's commitment to be the center of excellence in the field of metals industry, is centered on its commitment to enhance customer satisfaction.

Planning & Management

The Planning and Management Division (PMD), through the Planning and Evaluation Service and Management Information Service, continues to deliver professional technical support in the formulation and monitoring of the Center's plans and programs and in the development, modification and maintenance of information systems that are essential in supporting the major services of the MIRDC.

In 2015, PMD was at the forefront of packaging the MIRDC Strategic Plan 2015-2025, which shall serve as a blueprint of the Center in fulfilling its Vision, Mission and Goals. PMD has also contributed in deepening the Center's collaboration with industry by providing support to the Aerospace Industries Association of the Philippines (AIAP). PMD also initiated the establishment of linkages with two (2) German research institutes through a study mission funded by the Bases Conversion Development Authority (BCDA).

Linkage Development: Study Mission to Germany

In 2014, the Metals Industry Research and Development Center implemented the project entitled, ***"Capability Building for Science, Technology and Innovation (STI) towards a Self-Sustaining Research and Development Institutes (RDIs) of the DOST"*** through a grant from the DOST-PCIEERD which administers the Bases Conversion Development Authority (BCDA) funds. In the same year, representatives from the Center joined the Mission 1 in South Korea and Japan. As a spin-off to the first mission, the 2nd mission was conducted in Germany on April 13-17, 2015. Dr. Agustin M. Fudolig, Deputy Executive Director for Technical Services, Engr. Jonathan Q. Puerto, Deputy Executive Director for Research and Development and Ms. Mercedita G. Abutal, Chief of the PMD, represented MIRDC.

Two (2) institutes which are part of the world–renowned Fraunhofer Gesellschaft offering programs similar to that of MIRDC were visited by the study mission - the Fraunhofer Institute for Machine Tools and Forming Technology and the Fraunhofer Institute for Production Technology. Significant technologies and good practices which are of interest to MIRDC were observed such as the idea of "whole process" chain which closely resembles the vertical integration of the production process, the concept of E3 factory (energy and resource efficient, emission neutral factory and human embedding into production) and close collaboration with industry partners in implementing the "Tool and Die Academy." The Academy is of vital importance in the advancement of the tool and die technology of the country.

Hannover Messe/Hannover Fair 2015 held in Germany.

Another highlight of the study mission is the visit and attendance to the Hannover Messe/Hannover Fair 2015, the world's biggest industrial fair held annually on the Hannover fairground in Hannover, Germany. Yearly, some 6,500 companies from 70 countries showcase their respective technologies for the future's production plants and energy systems.

The five–day study mission to Germany resulted to the identification of several areas for collaboration with the visited institutes that might be included on the course of action of the Center in upgrading its capabilities and facilities. This includes information exchange and dispatch of German experts, short-term training of engineers on tool and die, surface coating/additive manufacturing technology and immersion to International Winter University (IWU) and Institute for Production Technology (IPT) through enrolment to graduate and post-graduate courses at the Fraunhofer affiliated universities.

Development of 2015-2025 MIRDC Strategic Plan

Since 1994, the MIRDC has been regularly conducting strategic planning sessions in order to revisit the vision, mission and strategic advantages of the Center to ensure the alignment of its priorities to the ever changing local and global dynamics of the M&E industries.

After a series of sessions and workshops, the packaged ten-year strategic plan (2015-2025) was released this 2015 through the efforts made by the PMD, the other Divisions and the Top Management. The strategic plan shall be the groundwork of the men and women of MIRDC in pursuing the commitment of the Center to the productivity and empowerment of the metals, engineering and allied industries.

The first part of the document provides an overview of the vision, mission, core values and the strategic objectives of the MIRDC as shown below:

Vision

"Center of excellence in science, technology and innovation for globally competitive metals, engineering and 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 and technicians; information exchange; quality control and testing; research and development; technology transfer; and business economics advisory services."

Core Values

The new set of core values, represented by the acronym PRIDE, is defined as follows:

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 industry.
- 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.

The MIRDC Strategic Objectives which are geared towards the responsiveness of MIRDC in addressing the needs of the industry are as follows:

MIRDC Strategic Objectives

*F*ocus on Customers
*I*ndustry Competitiveness
*R*esponsive to the National Priorities
*S*ervice Improvement
*T*echnological Self-Reliance

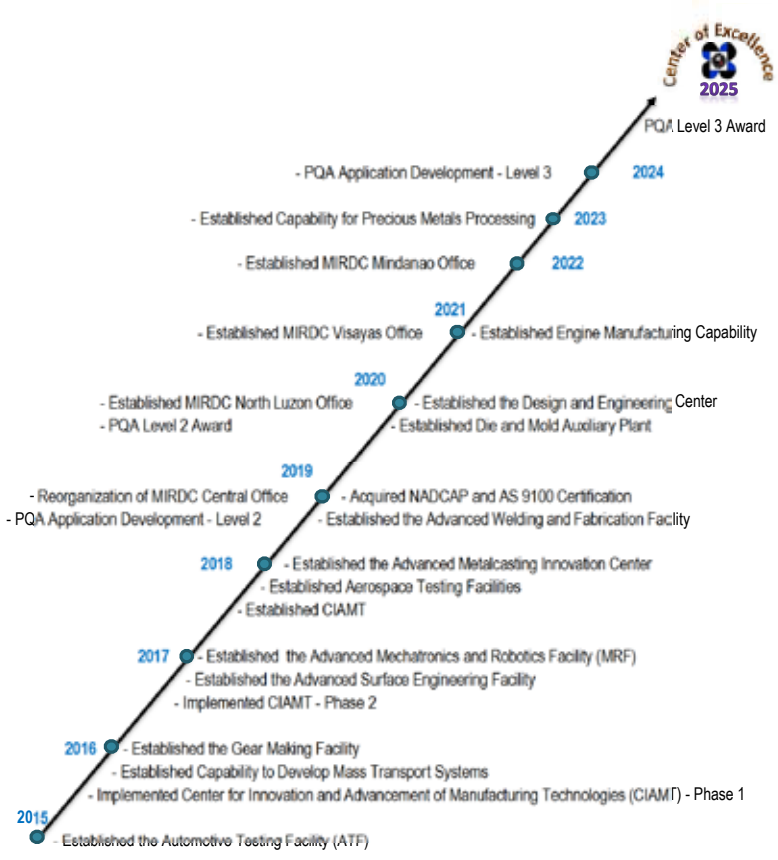


Figure 1. MIRDC Roadmap 2015 - 2025

PEZA D.G. Lilia B. De Lima during the AIAP Industry Forum on Aerospace.

The milestones that the Center wishes to achieve in the next ten (10) years covering the major Programs, Projects and Activities (PPAs) planned to be undertaken are laid fully in the roadmap shown in Figure 1.

Moving Forward with the Aerospace Industry

In 2015, MIRDC, through the Office of the Executive Director (OED) and the PMD, continued to strengthen its partnership and collaboration with the Aerospace Industries Association of the Philippines (AIAP) to move forward towards the implementation of programs and projects that will propel the industry's growth.

The Center participated in various foras and events showcasing the Philippine aerospace industry. Engr. Robert O. Dizon, served as Key Speaker during the "Engaging the Stakeholders' Forum" Series co-organized by AIAP and the Civil Aviation Authority of the Philippines (CAAP) with the theme "Bringing the Aerospace Industries Together" held at the Heritage Hotel Manila last April 13-14. Engr. Dizon discussed DOST-MIRDC's initiatives for the aerospace industry.

MIRDC, through PMD, also co-organized the "Invest in the Aerospace Industry Fora" held at the Silver Auditorium last 31 July 2015. Government officials, led by honoured guests, Ms. Lilia B. de Lima, Director General of the Philippine Economic Zone Authority (PEZA), and Dr. Amelia P. Guevara, DOST Undersecretary for Research and Development, signified support to the growth and development of the industry. Engr. Robert O. Dizon showcased the Center's facilities and capability-building programs catering to the metals and engineering (M&E) industries which include the aerospace sector. Speakers from the Board of Investments (BOI) and the Development Bank of the Philippines (DBP) also talked about their respective agency's programs in support of firms in the sector.

Representatives from the country's Tier 1 companies, which supply directly to aircraft manufacturers, such as Boeing and Airbus, talked about opportunities and existing gaps in the growing Philippine aerospace industry. The resource speakers from Moog Controls Philippines Inc., Jamco Philippines, B/E Aerospace and Surface Technology International emphasized the need to develop the Philippine aerospace industry supply chain. The event was attended by more than 130 participants and enticed 5 companies to become members of the AIAP.

Dr. Agustin M. Fudolig, Deputy Executive Director for Technical Services, was invited as panel discussant with the topic "The Future of the Philippine Aerospace Industries within the ASEAN Single Aviation Market (ASAM)" during the Philippine Aviation Summit held at the Manila Peninsula Hotel Makati last September 24-25.

MIRDC is also an active member of the DTI Board of Investments' Technical Working Group for the implementation of the aerospace industry roadmap. Last October, MIRDC officials, led by Engr. Robert O. Dizon, hosted the AIAP Board of Trustees and Ms. Ma. Corazon Halili-Dichosa, Supervising Director of the Board of Investments Industry Development Group and Sectoral Champion for the aerospace industry, discussed how MIRDC initiatives could be adopted by the interagency TWG as the umbrella program for the industry. Relative to this, the MIRDC packaged a program proposal entitled, "Local Interventions for Philippine Aerospace Development" or the LIPAD program to source possible funding under DOST – GIA and the Manufacturing Resurgence Program of the Department of Trade and Industry/BOI (DTI/BOI). The LIPAD program is envisioned to contribute to enhancing the capacity and integrating the supply chain of the Philippine aerospace industry. Each project under the LIPAD program shall focus on the provision of process capabilities to address existing supply gaps identified in the Philippine aerospace industry roadmap.

Administrative & General Services

The Finance and Administrative Division (FAD) serves as a support group whose task is to safeguard the Center's financial standing and ensure that its human resource requirement is met for optimum employee performance in order to deliver its services to both government and private sectors with a very satisfactory customer satisfaction rating.

Personnel Strength

By the end of 2015, the Metals Industry Research and Development Center was able to sustain and strengthen its operations with a total workforce of 213 or 94.24% based from its 226 approved plantilla position. During the year, the Center gained fourteen (14) new employees and promoted seven (7) personnel from its existing pool of talents. However, a total of three (3) employees were separated from government office after rendering an average of 37 years of public service.

The personnel movement as a result of promotions and transfers and new entrants is detailed as follows:

PROMOTED EMPLOYEES

Rommel N. Coroña
Supervising Science Research Specialist
Analysis &Testing Division

Paul Danniel P. Aquino
Sr. Science Research Specialist
Analysis &Testing Division

Agnes F. Pedraza
Administrative Officer V
Finance & Administrative Division

Jojit M. Velasco
Science Research Specialist II
Materials & Process Research Division

Dolly Marie T. Borlado
Administrative Officer II
Finance & Administrative Division

Laureano L. Dalay
Metals Technologist V
Prototyping Division

Kristine A. Gealan
Administrative Assistant III
Technology Diffusion Division

TRANSFEREES

Johnny G. Quingco
Accountant IV
Finance & Administrative Division
(Transferee from DOST-NCR)

Laila R. Porlucas
Administrative Officer IV
Finance & Administrative Division
(Transferee from FNRI)

NEW EMPLOYEES

Jo Marie Venus T. Agad
Sr. Science Research Specialist
Analysis & Testing Division

Rey N. Mariposque
Science Research Specialist II
Technology Diffusion Division

Alma C. Dupagan
Training Specialist II
Technology Diffusion Division

Leandro B. Olesco, Jr.
Training Specialist II
Technology Diffusion Division

Reynaldo O. Bayot
Engineer I
Finance & Administrative Division

Francis Albert M. Ferrer
Information System Analyst I
Planning & Management Division

Eunice A. Bautista
Training Specialist I
Technology Diffusion Division

Pascual N. Lumanta
Metals Technologist III
Prototyping Division

Joy E. Cabaña
Administrative Officer I
Finance & Administrative Division

Abigail M. Casas
Administrative Assistant I
Office of the Executive Director

Tracy Ann U. Tolentino
Administrative Assistant I
Prototyping Division

Jerameel C. Falcatan
Administrative Assistant I
Analysis & Testing Division

RETIREES

	Effectivity Date of Retirement	Years of Service
 Marcelino V. Alvior Metals Technologist V Prototyping Division	January 9, 2015	38
 Blesilda P. Cabaña Accountant IV Finance & Administrative Division	June 30, 2015	37
 Myrna M. de Guzman Administrative Officer V Finance & Administrative Division	September 30, 2015	37

		Research & Development			Technical Services		
	OED	MPRD	PD	PMD	ATD	TDD	FAD
Engineers	2	10	18	-	15	10	3
Non-Engineers (Technical)	1	18	25	12	18	3	-
Admin/Support/Non-Technical	1	5	6	4	4	20	38

Currently, MIRDC employs a total of 135 technical and 77 non-technical personnel under the three (3) directorates of the Center, namely: Office of the Executive Director, Research and Development and Technical Services. The distribution of manpower is presented in the table above.

Over the years, the Center was able to enhance its personnel development initiatives through local and foreign trainings and scholarship programs. In this way, its human resource requirement is continuously upgraded thus, improving their professional and personal growth.

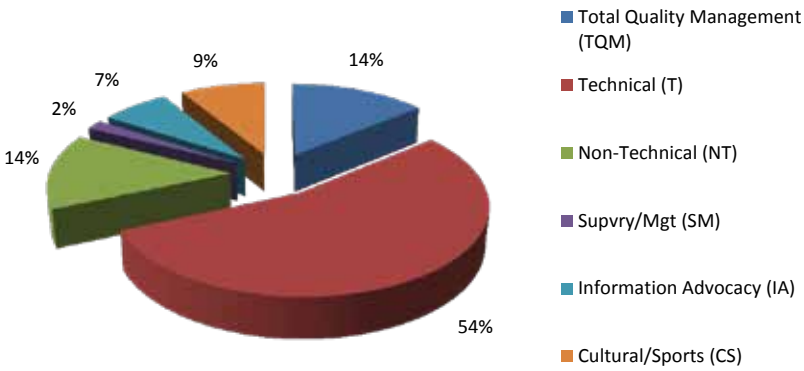
CAREER AND PERSONNEL ENRICHMENT

Staff Development Programs

With an annual target of forty five (45) local training programs from the 2015 Human Resource Development Plan, the Administrative and General Services Section (AGSS) has implemented a total of fifty eight (58) programs for its personnel that resulted to a 128.88% accomplishment of its functional objective. This is exclusive of the twenty three (23) additional programs and forty nine (49) unplanned programs that were implemented by the Staff Development Unit.

As one of the major contributors in enriching the competence of its current workforce, FAD-AGSS facilitated several training programs that were classified into six types, namely: (1) Total Quality Management, (2) Technical, (3) Non-Technical, (4) Supervisory and Management, (5) Information advocacy and (6) Cultural and Sports. The Figure above shows the percentage distribution of the types of programs that were implemented from January – December 2015.

Among the major highlights of these accomplishments was the conduct on October 13-15, 2015 of the Training on Management of the R&D Talents in the DOST "How to Attract, Align, Motivate and Keep Your Best Talents" by Business Maker Academy, Inc. at MIRDC. This was made possible through the approval of the aforementioned project proposal by the DOST Human Resource Development Program chaired by Undersecretary Rowena Cristina L. Guevara.



2015 HRDP Program Percentage Distribution, by Classification

DOST Usec. Rowena Cristina L. Guevara delivering her message before the participating agencies.

This was spearheaded by FAD-AGSS with the objective of bridging the gap between the HR Practitioners and Managers in the selection, evaluation and management of the DOST RDIs' pool of talents. Participating agencies were DOST Central Office, DOST HRDP Secretariat, FNRI, ITDI, NAST, NRCP, PCAARRD, PCHRD, PCIEERD, PHIVOLCS, PNRI and MIRDC.

DOST Asec. Robert O. Dizon with his team members during the group activity.

Scholarship Program

With the continuing provision of the scholarship grants by the DOST-HRDP, another set of grantees successfully obtained the 2015 scholarship program. A total of four (4) employees availed of a master's degree program and one (1) under a doctorate program (see details below).

Added to this was the successful completion of the doctorate degree program in Public Administration by Ms. Jelly N. Ortiz at the Polytechnic University of the Philippines on May 8, 2015.

By the end of the year, MIRDC gained a total of six (6) doctorate degree holders and twenty seven (27) master's degree holders in the field of engineering, technology management, business management, public administration and philosophy. On-going scholarship program is being availed by fifteen (15) personnel with four (4) doctorate degree and eleven (11) master's degree programs.

Participants at work during their group activities.

Participants of the "How to Attract, Align, Motivate and Keep Your Best Talents" in their group pictures.

Scholarship Program Grantees

Name of Personnel	Division	Degree	University
Arlene G. Estacio	ATD	Doctor of Philosophy in Electronics Engineering	Mapua Institute of Technology
Marie Sharon S. Abilay	ATD	MS in Electrical Engineering	Technological University of the Philippines-Manila
Louren Joy G. Asmando	ATD	Master of Technology	Technological University of the Philippines-Manila
Sheena S. Bedis	PMD	Master in Development Economics	University of the Philippines – Diliman
Lemuel N. Apusaga	MPRD	Master in Metallurgical Engineering	University of the Philippines – Diliman

Foreign Program

A total of twenty five (25) foreign travels were facilitated for the year 2015 funded by various DOST-GIA projects and supported by private/government sector counterpart. Through this, FAD-AGSS deployed a total of thirty seven (37) personnel in different parts of Asia, Europe and the United States of America. Below are the details of the foreign program and activities from January-December 2015.

REPORT ON FOREIGN TRAVEL, January - December 2015

	NAME	POSITION	DATE OF TRAVEL		PURPOSE	DESTINATION	SPONSOR/INVITING PARTY
			Departure	Arrival			
1	Florante A. Catalan Arvin Yan V. Pacia	Supervising SRS SRS II	1/25/2015	1/31/2015	Training Courses on the Utilization of Equipment (Vibration Test System Model G-0210N)	Japan	Maedan Ent., Inc./ TUFF Trading/VG Roxas Co., Inc.
2	Gina A. Catalan	Supervising SRS	3/2/2015	3/5/2015	Training on Heat Resistance Test	Malaysia	Elasco Int'l. Corp. / MajuSaintifik SDN. Bhd.
3	Jayson P. Rogelio Ronie S. Alamon	Sr. SRS SRS II	3/18/2015	3/20/2015	Paper Presentation for the International Multi-conference of Engineers and Computer Scientists (IMECS) 2015	Hong Kong	PCIEERD-HRDP DOST-GIA Project
4	Dr. Dominic S. Guevarra	Sr SRS	3/18/2015	3/20/2015	Paper Presentation for the International Multi-conference of Engineers and Computer Scientists (IMECS) 2015	Hong Kong	DOST-GIA Project
5	Cameron B. Yao	SRS II	3/3/2015	3/5/2015	Training on Palmary Cylindrical Grinder Model GU20X40NC	Taiwan	MESCO, Inc
6	Dr. Agustin M. Fudolig Jonathan Q. Puerto Mercedita G. Abutal	Dep. Exec. Dir. Dep. Exec. Dir. Chief Planning Officer	4/13/2015	4/17/2015	Study Mission for "Capacity Building for Science, Technology and Innovation Towards a Self-Sustaining Research and Development Institutes (RDIs) of the DOST Mission 2"	Germany	DOST-PCIEERD
7	Augusto S. Atanacio Jr. Simplicio N. Morla Jr. Vincent Boy E. Manabat Walter A. Bonggat	Metals Tech V Metals Tech IV Metals Tech III Metals Tech II	4/12/2015	4/17/2015	Training on Advance CNC Milling and Programming	Japan	MESCO, Inc. Phils./ DOST-GIA Project
8	Edward A. Malit Jeffrey C. Obregon	SRS II Lab Insp. II	4/13/2015	4/15/2015	Training Course for the Utilization of Hi-Speed Camera Equipment for the Transport Body Impact Tester	Singapore	RITVIT Construction and Dev't. Corp. and DOST-GIA Project
9	Fred P. Liza	Chief SRS	4/19/2015	4/22/2015	Study Tour of the German-Thai Chamber of Commerce German-Thai Dual Excellence Education (GTCC/GTDEE)	Thailand	German-Phil. Chamber of Commerce and Industry
10	Florante A. Catalan Arvin Yan V. Pacia	Supervising SRS SRS II	4/27/2015	4/30/2015	Training Course on In-Vehicle Data Logging Software	Singapore	VG Roxas Co., Inc.
11	Robert O. Dizon Fred P. Liza Dr. Dominic S. Guevarra Noli P. Alvior	Asst. Sec, DOST & OIC, MIRDC Chief SRS Sr. SRS Lab Insp. I	5/5/2015	5/13/2015	Factory Final Acceptance Test of CMM Duramax RT 5/5/5 Equipment	Germany	Carl Zeiss (IndustrielleMessTechnik GmbH) and DOST-GIA Project

REPORT ON FOREIGN TRAVEL, January - December 2015 (Continuation)

	NAME	POSITION	DATE OF TRAVEL		PURPOSE	DESTINATION	SPONSOR/INVITING PARTY
			Departure	Arrival			
12	Reynaldo L. Dela Cruz Jr.	Training Specialist IV	5/12/2015	5/14/2015	23rd Asian Welding Federation (AWF) Meeting, 16th Common Welder Certification Scheme (CWCS) Task Force Meeting and 6th Standardization Task Force Meeting	Thailand	Phil. Welding Society
13	Emerito V. Banal Wilfredo M. Ramilo Edwin S. Jucutan Noel R. Datul	Sr SRS Metals Tech IV Metals Tech III Metals Tech II	6/15/2015	6/20/2015	Pre-Acceptance, Operation and Maintenance Training on Hydraulic Die Spotting Press	China	Gecar Machine Solutions, Inc. and DOST-GIA Project
14	Raymond S. De Ocampo Camilo C. Cariaga Alfred M. Tujon Laureano L. Dalay	SRS II Metals Tech III Metals Tech III Adm Asst III	6/24/2015	6/25/2015	In-House Exhibition entitled "Amada Innovation Fair 2015" and Training on Punch Press and Hydraulic Shear	Japan	MESCO, Inc. and DOST-GIA Project
15	Lemuel N. Apusaga Melchor A. Gamilla	Sr SRS SRS II	6/29/2015	7/10/2015	MAGMA Investment Casting and MAGMA Cast Iron Training	Singapore	BCDA Project "Bridging the HR Competency Gaps in Support of the Natl. R&D Agenda
16	Osric Primo Bern A. Quibot	Senior SRS	7/1/2015	7/31/2016	Master's Degree on International Development	Japan	Japanese Grant Aid for Human Res. Devt. Scholarship Program
17	Ely C. Delos Reyes Noli P. Alvior	Metals Technologist V Lab. Inspector I	7/5/2015	7/8/2015	Orientation and Training on Quick Vision Probe	Singapore	MESCO, Inc. & Project
18	Morris DR. Pioquinto Lito I. Dimaculangan	SRS II Metals Technologist III	7/7/2015	7/10/2015	Training for Thermo Scientific Portable Analytical Instruments (thermo PAI)-NITON-Analyzer	Kong Kong, China	Brownstone Asia-Tech, Inc.
19	Dr. Agustin M. Fudolig Florante A. Catalan	Dep. Exec. Dir. Supervising SRS	9/21/2015	9/23/2015	Conduct of Pre-Delivery Equipment Inspection of the Tire Endurance Testing Equipment	Taiwan	All Well Industry Co., Ltd. & Project
20	Samuel A. Ysit	Electrical Inspector II	10/5/2015	12/13/2015	Certificate Course on Industrial Electronics and Instrumentation	India	Indian Technical and Economic Cooperation (ITEC)
21	Mercedita G. Abutal	Planning Officer V	10/12/2015	10/16/2015	Chief Information Officers Training Programme on the Strategic Management of Information Technology	Singapore	Govt. of Singapore Cooperation Programme
22	Reynaldo L. Dela Cruz Jr.	Training Specialist IV	10/20/2015	10/23/2015	24th Asian Welding Foundation (AWF) Meeting, Common Welder Certification Scheme (CWCS) Task Force Meeting and the 7th Standardization Task Force Meeting	Indonesia	Phil. Welding Society
23	Fred P. Liza Jayson P. Rogelio	Chief SRS Sr. SRS	10/21/2015	10/30/2015	Meeting, Facility/ Study Tour	USA	Intl. Assoc. of Engineers; UC Berkeley, MAZAK & CNC Software, Inc.; PCIEERD-HRDP & DOST-GIA Projects
24	Ely C. Delos Reyes Bobby F. Fronda Simplicio N. Morla, Jr. Amado D. Tagal Jr.	Metals Tech. V Metals Tech. IV Metals Tech. IV Metals Tech. III	11/23/2015	11/27/2015	Training on High Speed Vertical Machine (F5) and Integrated Manual/CNC Milling Machine (KE55)	Singapore	Makino Asia Pte., Ltd. and DOST-GIA Project
25	Dr. Agustin M. Fudolig Florante A. Catalan	Dep. Exec. Dir. Supervising SRS	12/7/2015	12/11/2015	Pre- Acceptance/Pre- Delivery Inspection and After Sales Instructions of Equipment	Belgium	HMC Sales and Service Pte., Ltd. of Singapore

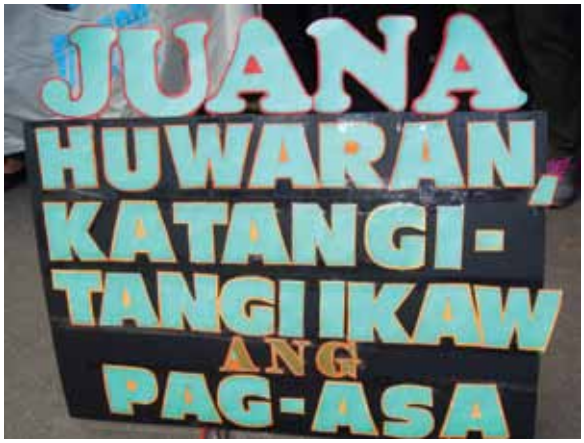
2015 National Women's Month Celebration

MIRDC deployed ten (10) representatives in the 2015 National Women's Month Celebration on March 8, 2015 at the Quezon City Circle, Quezon City where all participating government agencies convened to celebrate this year's event themed as "Juana, Desisyon mo ay Mahalaga sa Kinabukasan ng Bawat Isa, Ikaw Na!"

A simultaneous nationwide street dance was held in the QC Circle grounds that marked the celebration of the achievements in empowering Juanas and encouraging more Juanas to step-up, participate and lead in the different sectors of the country.

Aside from this, a DOST-wide celebration of the same event was held at the DOST grounds on March 16, 2015. This was organized by the DOST GAD Focal Point System wherein twenty two (22) DOST agencies joined the parade and took part in the slogan and poster making contests .


MIRDC's representatives in the 2015 National Women's Month Celebration at the QC Circle, Quezon City.

MIRDC's entry in the 2015 DOST National Women's Month Celebration slogan and poster making contests conceptualized by Mr. Ronaldo L. Agustin of the Technology Diffusion Division.


MIRDC female employees during the parade.

Asec. Robert O. Dizon as one of the judges during the celebration.

MIRDC 2015 Teambuilding

MIRDC held on May 14-15, 2015 its 2015 Teambuilding and Sportsfest Awarding Ceremony at the Punta de Uian Resort and Spa located at Pundaquit, San Antonio, Zambales with the theme - MIRDC ALOHA KALOKA.

All employees came in their leis, straw hats, hawaiian skirts, shirts and shorts that complemented the Polynesian-inspired celebration. Everyone was enjoined to participate in the fun-filled obstacle games that were strategically laid out on the sandy beach. The games encouraged both management and staff to participate energetically and promoted sportsmanship as well.

Part of the main event was the Aloha-Kaloka contest wherein each division presented their Mr./Ms. Aloha Kaloka candidates in a cross-dressed Polynesian costume. To complete the task, each representative performed their best talent and provided their most kaloka answer in the Q&A portion.

This year, the Technology Diffusion Division got the Mr./Ms. Aloha Kaloka of the Night award in performing the "buwis-buhay" fire dance that got the judges off their seats.

Topping the night's celebration was the Best Division Chant competition which was won by the FAD and PD.

Participants in their energetic feat during the relay games.

Glimpses of management and staff having fun under the sun.

Mr. & Ms. Aloha Kaloka Champion Eugene P. Guevara and Jaquelin J. Agonoy of TDD.

MIRDC 49th Anniversary

MIRDC celebrated its 49th anniversary on June 29, 2015 with the theme "MIRDC Goes Western" at the MIRDC 3/F Gold Auditorium. Employees and guests came in their cowboy and cowgirl costumes, anticipating the fun and excitement that will come their way. This year's celebration had a hint of nostalgia due to the presence of the twenty six (26) ex-MIRDC personnel who were invited and took part in the program of activities. This was made possible through the joint effort of Engr. Fred P. Liza, Chief of the Prototyping Division and Ms. Zenaida M. Cruzada, former Section Chief of the HRMMS (now FAD-AGSS), who crafted the idea of the Ex-MEN (Ex-MIRDC Employees Network) gathering and mobilizing the attendance of MIRDC retirees and former employees, respectively.

Special guests from the Ex-MEN (Ex- MIRDC Employees Network) render a song number.

MIRDC 2015 Awards and Recognitions

MIRDC, through its PRAISE committee, gave due recogniition to the following employees:

LOYALTY AWARD	
No. of Years	**Awardees**
Forty (40) Years	• Cesar B. Andres
Forty (35) Years	• Virgilio P. Lim • Jose B. Ferrer
Thirty (30) Years	• Romeo C. Bermudez • Gabriel D. Galotia • Ronilo C. Sanchez • Mercedita G. Abutal • Francisco P. Dela Peña • Laureano L. Dalay • Juanito G. Mallari
Twenty Five (25) Years	• Francisco C. Dime • Dominic S. Guevarra • Concesa T. Cortez • Rio S. Pagtalunan • Reynaldo L. Dela Cruz, Jr. • Virgilio H. Macanip • Danilo N. Pilar • Jonathan Q. Puerto • Francisco M. Marasigan • Zenaida L. Jumilla • Edilbert M. Dela Peña • Rommel G. Adame • Rosario D. Sancon • Jaysay L. Bactad
Twenty (20) Years	• Rommel N. Coroña • Eduardo V. Diasanta, Jr. • Romulo V. Alano • Alfred M. Tujon • Emerito V. Banal • Agnes F. Pedraza
Ten (10) Years	• Pablo Q. Acuin

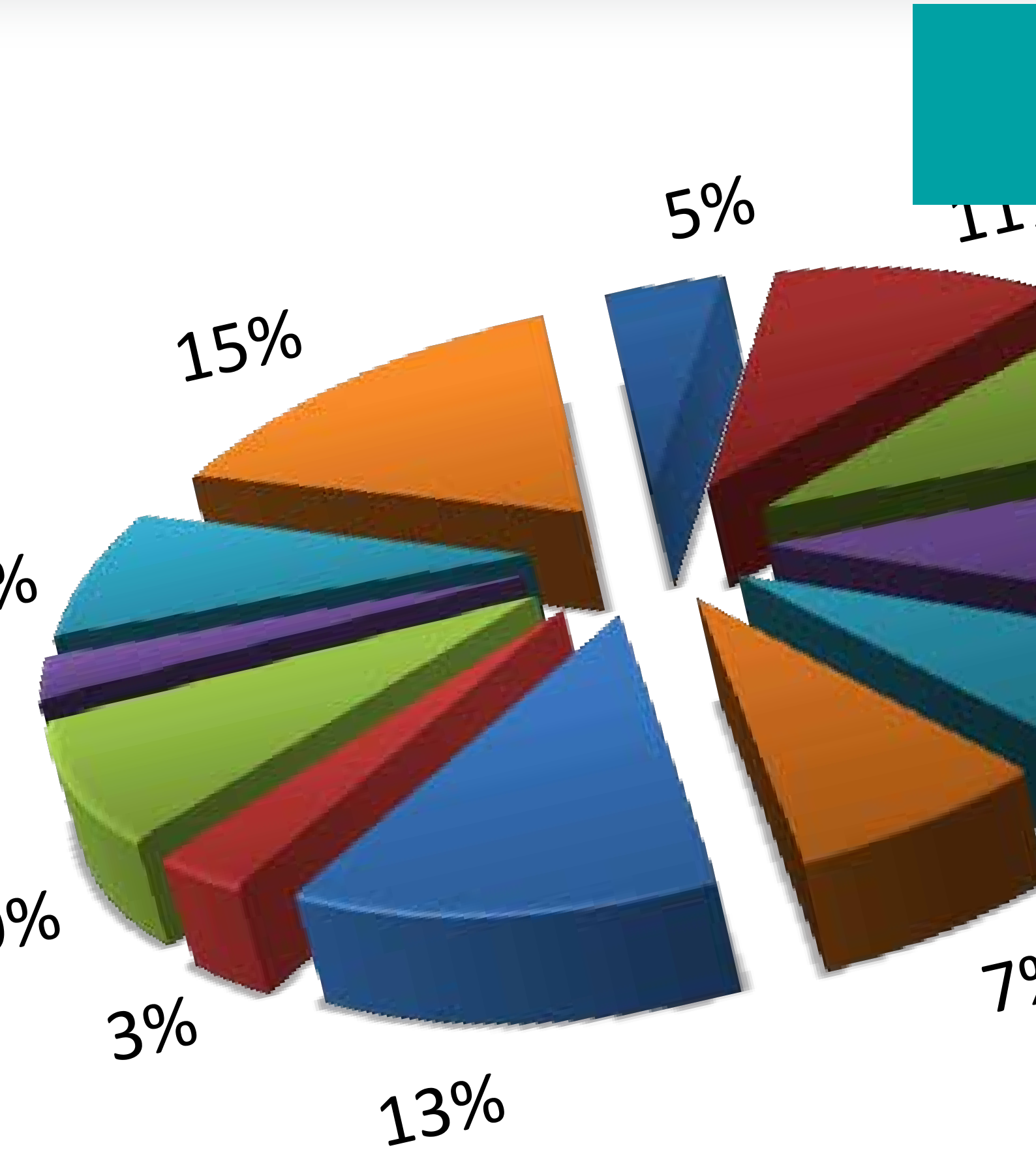
PERFORMANCE EXCELLENCE	
No. of Years	**Awardees**
4 Consecutive years (2011-2014)	• Noli P. Alvior • Francisco M. Marasigan
3 Consecutive years (2012-2014)	• Reynaldo M. Loreto, Jr. • Simplicio N. Morla, Jr.
2 Consecutive years (2013-2014)	• Ronaldo L. Agustin

CORE VALUE	
Professionalism	Marcela R. Cagalingan
Responsiveness	Eric B. Casila
Integrity	Jonifer Rose D. Bernaldez
Dynamism	Linda G. Rivera
Excellence	Jayson P. Rogelio
Best driver	Edmundo C. Sevilla
Certificate of Merit for Int'l Conference on Intelligent Automation and Robotics 2015	Fred P. Liza Jayson P. Rogelio
2015 DOST Utility Model Registration Award - Pandan Leaf Slitter	Francisco C. Dime Allan John S. Limson
Certificate of Merit for Int'l Conference on Control and Automation	Ronie S. Alamon

DIVISION MODEL EMPLOYEE	
Level I	• Samuel A. Ysit • Alfredo Z. Panganiban • Joseph A. Romero • Evelyn D. Inventor • Vincent Boy E, Manabat
Level II	• Gina A. Catalan • Rea C. Castro • Ligaya M. Rubis • Nelson L. Tumibay • Gharry M. Bathan

MIRDC MODEL EMPLOYEE	
Level I	• Alfredo Z. Panganiban
Level II	• Gina A. Catalan
Best Organizational Unit	• Industrial Training Section

SPECIAL AWARDS	
UTILITY MODEL	
1. Universal Holder Reg. No. 2-2011-000267	• Jose B. Ferrer • Gharry M. Bathan • Francisco C. Dime • Amado R. Jabrica
2. Trivalent Chromating Solution Reg. No. 2-2011-000645	• Maria Gracia M. Peralta • Keziah M. Dela Rama • Felix C. Banawa
3. Coco Log Extrusion Machine Reg. No. 2-2011-000547	• Arthur Lucas D. Cruz • Francisco C. Dime • Jose B. Ferrer • Rommel G. Adame • Amado D. Tagal, Jr. • Wilfredo M. Ramilo • Camilo C. Cariaga
4. Dewatering Machine for Water Hyacinth Reg. No. 2-2010-000610	• Francisco C. Dime • Rommel G. Adame
5. Pandanus Leaves Slitter-Presser Reg. No. 2-2011-000270	• Allan John S. Limson • Jose B. Ferrer • Francisco C. Dime • Manuel F. Ascaño • Wilfredo M. Ramilo • Laureano L. Dalay • Amado R. Jabrica
Graduate Studies	• Paul Danniel P. Aquino • Jelly N. Ortiz
Paper Presenter	• Dominic S. Guevarra • Joein L. Luces • Melvin L. Vista
Best Poster	• Jayson P. Rogelio • Renann G. Baldovino • Geoffrey L. Abulencia • Tracy Ann U. Tolentino
Certified Local Auditor	• Reynaldo L. Dela Cruz, Jr.


5%
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13%

It is said that no organization can successfully exist without a sound financial plan and a strategy to effectively and efficiently utilize its limited resources, especially if such organization is a public entity and mandated to promote science and technology that is expected to be contributory to the attainment of the country's aspiration of rapid and inclusive economic growth.

REGULAR FUND: SOURCE AND UTILIZATION

The bulk of the Center's budget was geared towards promotion of research and development in the fields of metals and engineering with the aim of introducing breakthroughs in science and technology that would bring impact to the Philippine economy. The budget also included provisions for acquisition of machineries and equipment, as well as enhancement of its workshops and administrative buildings through refurbishment and retrofitting.

Allotment and Obligation

In 2015, the Metals Industry Research and Development Center (MIRDC) operated with a total approved budget of P301,012,974.63. Of which, P202,478,626.00 (67%) was for current year's appropriation and P98,534,348.63 (33%) was for continuing appropriation or budget accounted for in prior year. Under the current appropriation, 68% or P136,964,210.00 (inclusive of RLIP) was allotted for Personnel Services, 13% or P27,141,416.00 for MOOE, 3% or P5,373,000.00 for Capital Outlay and 16% or P33,000,000.00 for Locally Funded Projects-Regular.

Of the total allotment, the Center obligated P288,591,203.19 or posted 96% performance. Please refer to Fig. 1 below for details.

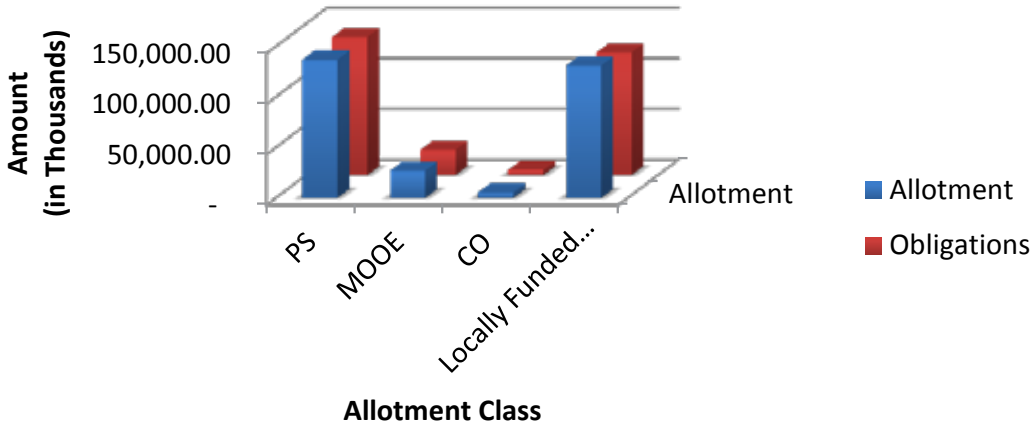

Figure 1. 2015 Allotment Received vs. Obligation

Source: MIRDC-FMS Budget Unit

Cash Allocation and Utilization

The cash requirement related to the 2015 budget was originally drawn in accordance with the agency's Physical Work Plan and in compliance to the provisions of DBM's National Budget Circular (NBC) No. 555 dated 10.28.14 and the accounts payable identified as of date of preparation. Please refer to Table 1 below for details.

Table 1. 2015 Original Cash Program

Particulars	Allotment *(in Thousands)*	Projected Tax *(in Thousands)*	Cash Allotment *(in Thousands)*
• Fiscal Year's Budget	190,550.00	12,534.00	178,016.00
• Continuing Appropriation	98,535.00	4,927.00	93,608.00
• Prior Year's Budget -Accounts Payable	112,685.00	431.00	112,254.00
Total	401,770.00	17,892.00	383,878.00

Source: MIRDC-FMS Budget Unit

During the preparation of the original Cash Program, the amounts considered were purely reflected in the Approved NEP for 2015. There was no provision for anticipated unliquidated obligation as of EOY2014. This caused a little setback in settling accounts payable, particularly those retention fees that were scheduled to fall due in 2015. This constraint, however, was remedied through constant request with the Department of Budget and Management (DBM) to fund immediate payables.

The total amount of cash released by the DBM during the year was P403,252,622.00 to the agency's Regular Modified Disbursement System (MDS) account. The amount was inclusive of allocations for accounts payable of P103,215,735.

As can be gleaned in Figure 2 below, December has the biggest allocation with 15% share in the distribution and October has the lowest with 3% only.

As of year-end, the agency posted 99.65% utilization rate on its regular and specific budget. It disbursed a total amount of P400,004,618.82.

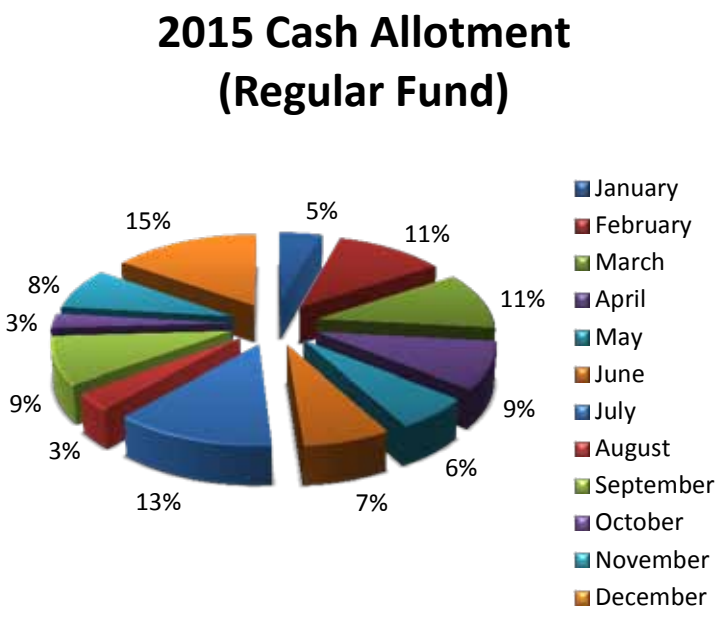

Figure 2. 2015 Cash Allotment Received (Regular Fund)

Source: MIRDC-FMS Accounting Unit

TRUST RECEIPTS: SOURCE AND UTILIZATION

MIRDC gained prominence in building prototypes that draw attention due to their unique and innovative concepts. The agency has undergone collaborative projects with other agencies. The Center received a total amount infused by its partner-agencies of P146,379,847.74. 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 P201,972,142.73 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 EOY2014.

The Center disbursed only P70,295,409.01 or 35% of the total cash allocation.

Table 2. Schedule of Fund Transfers from Funding Agencies in 2015

Funding Agency	Project Description	Amount
CLSU	*Design & Development of Forage-Blades & Chopper for Goat Production*	370,752.00
DFA	*Eyelet Riveter*	1,300,000.00
DOST	*Establishment of Gear Making & Assembly Facility*	49,141,000.00
DOST	*Management of R&D Talents in the DOST*	229,000.00
DOST	*One-Stop Shop Lab. for Global Competitiveness (One-Lab)*	5,757,564.00
DOST	*Roll-Out of DOST Developed Food Processing Equipt. to the Region*	29,347,158.00
DOST	*Single Cylinder (12 HP)*	7,890,400.00
DOST	*Trainset*	19,885,000.00
DTI-ARMM	*Establishment of Crucible Furnace Facility for Brass Casting*	381,900.00
PCAARRD	*Design & Dev't of Sugarcane Harvesting Equipment*	5,334,956.00
PCAARRD	*Design & Dev't of Superheated Steam Treatment System for Stabilized Brown Rice*	609,351.00
PCAARRD	*Dev't. of Hand Tractor Attachments to Harvester & Transplanter*	4,954,599.00
PCAARRD	*Dev't. of Fluidized Bed Dryer for Prod. of Subsidized Brown Rice*	1,720,075.00
PCIEERD	*Capacity Bldg. for S&T Innovation Towards a Self Sustaining R&D of DOST (BCDA)*	604,853.31
PCIEERD	*Dev't. of Heavy Duty DC Inverter SMAW GTAW Welding Machine*	230,000.00
PCIEERD	*Local Cacao*	637,355.43
PCIEERD	*Performance Testing of Five-Coach Centrally Powered Hybrid-Electric Road Train for Local Applications-Phase 2*	3,535,000.00
PCIEERD	*Simulation & Evaluation of AGTS Passenger Stations-Phase 2*	3,385,000.00
PCIEERD	*Test & Evaluation of 120-Passenger per Coach Capacity AGTS*	3,960,000.00
TAPI	*Vacuum Packaging Machine*	143,000.00
DOST	*Technoville Welding Skills*	245,000.00
DTI-BOI	*Establishment of a Die & Mold Solution Center in Support of the Components & Parts Mfg. Industry*	6,717,884.00
	Total	**146,379,847.74**

Source: MIRDC-FAD Cash Collection Unit

REVENUE GENERATED

MIRDC served various companies in terms of their industrial needs, 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 was able to generate revenues. These revenues were subsequently deposited to the National Treasury.

The total amount collected as revenues from various sources during the year was P30,198,716.42. The revenue breakdown is shown in Figure 3.

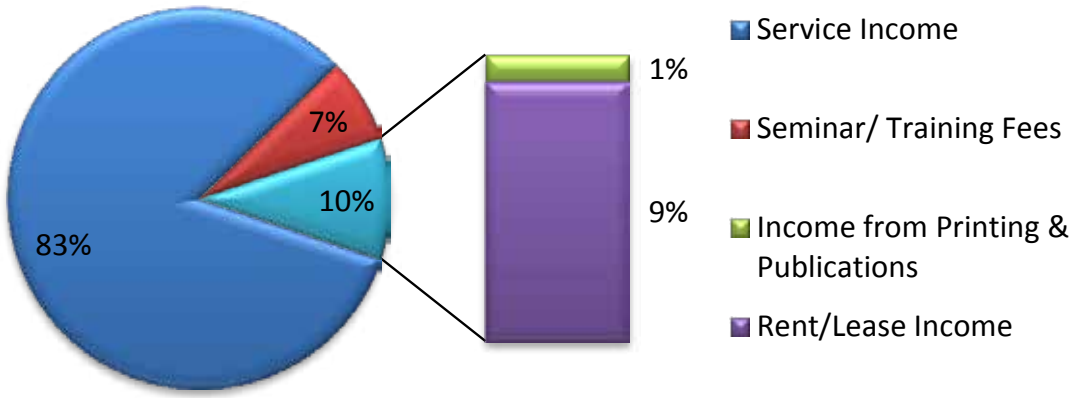

Figure 3. Distribution of Revenue Generated From Operation

Source: MIRDC-FAD Cash Collection Unit


50
YEARS
1966 - 2016
MIIRDC
we are going GOLD in June 2016

The Management

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

GOVERNING COUNCIL CHAIRMAN

MARIO G. MONTEJO
DOST Secretary

GOVERNING COUNCIL MEMBERS

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Metals Industry Sector

CORAZON H. DICHOSA
Board of Investment

MARCELO B. VILLANUEVA
Allied Industry Sector

ALBERTO M. ALBANO
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Department of Agriculture

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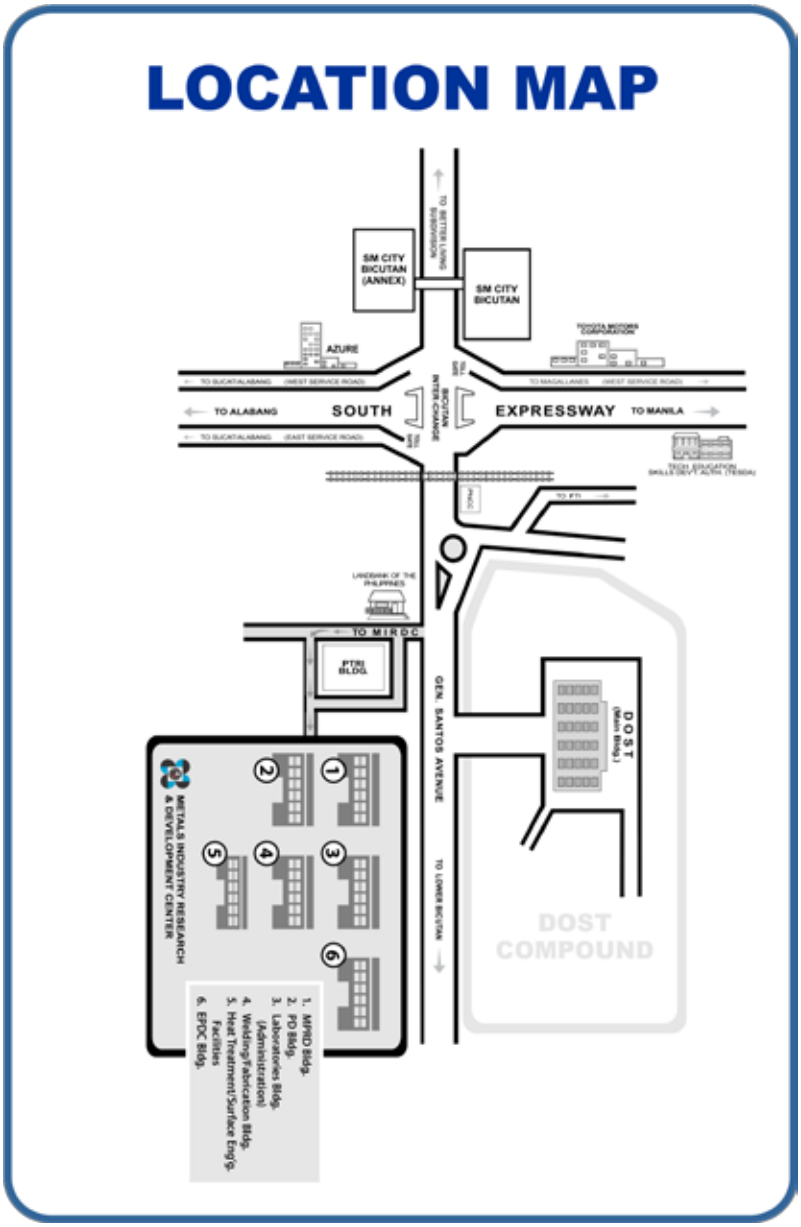
(Representative of Leo L. Jasareno)
Department of Environment and Natural Resources

GERARDO P. MAGLALANG
(Representative of Ann Claire C. Cabochan)
Bureau of Products Standards

BRENDA R. MENDOZA
National Economic & Development Authority

LOCATION MAP & EXTENSION OFFICES



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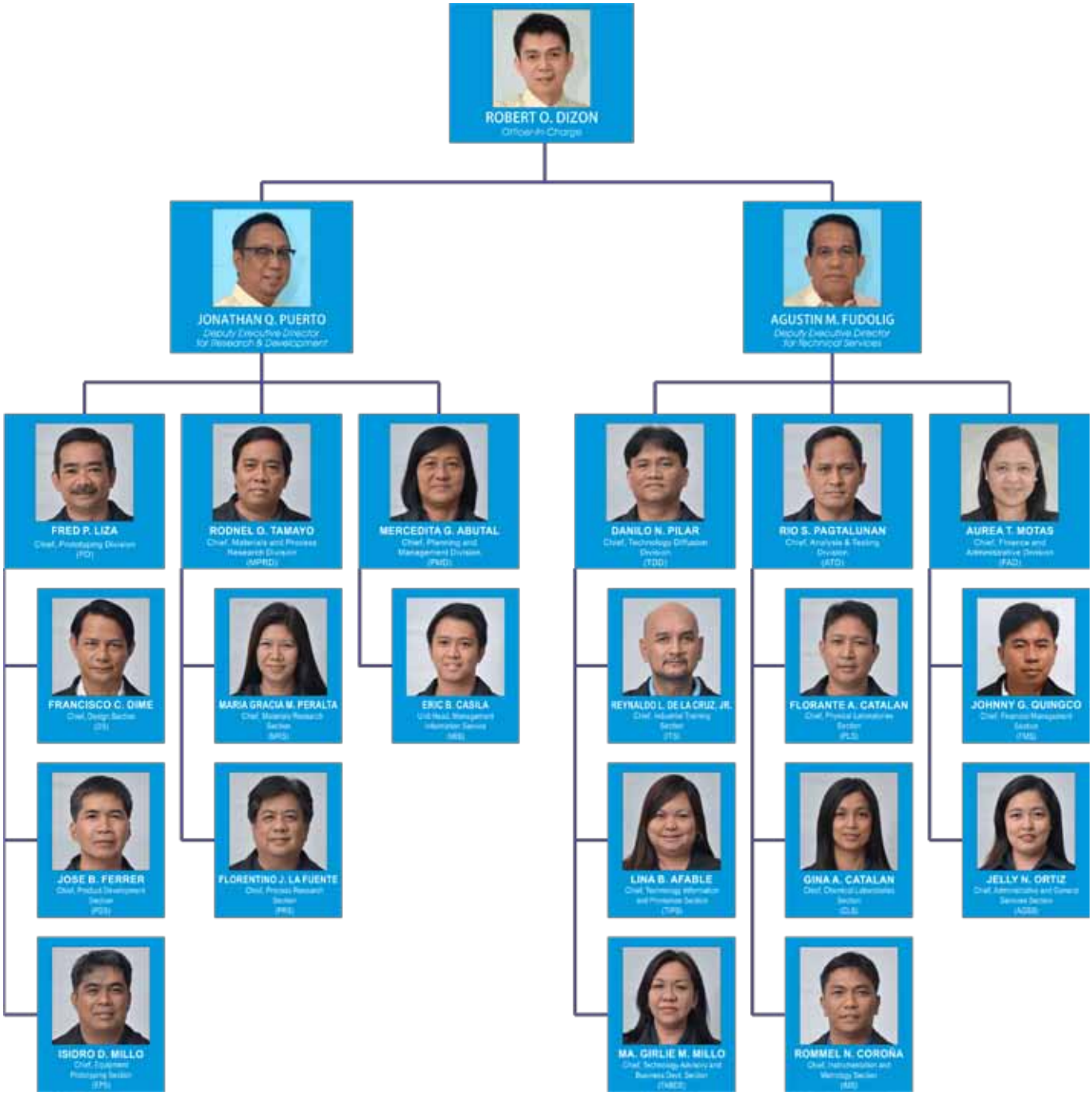
MIRDC ORGANIZATIONAL STRUCTURE



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 mabubuhat
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

Front (from left): Sheena S. Bedis, Maria Gracia M. Peralta, Marlyn U. Ramones, Danilo N. Pilar *(Editor-in-Chief)* Lina B. Afable, Zalda R. Gayahan, Marlene R. Rafanan
Back (from left) : Ronald L. Agustin, Fred P. Liza, Johnny G. Quingco, Christian Glenn S. Ligon

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