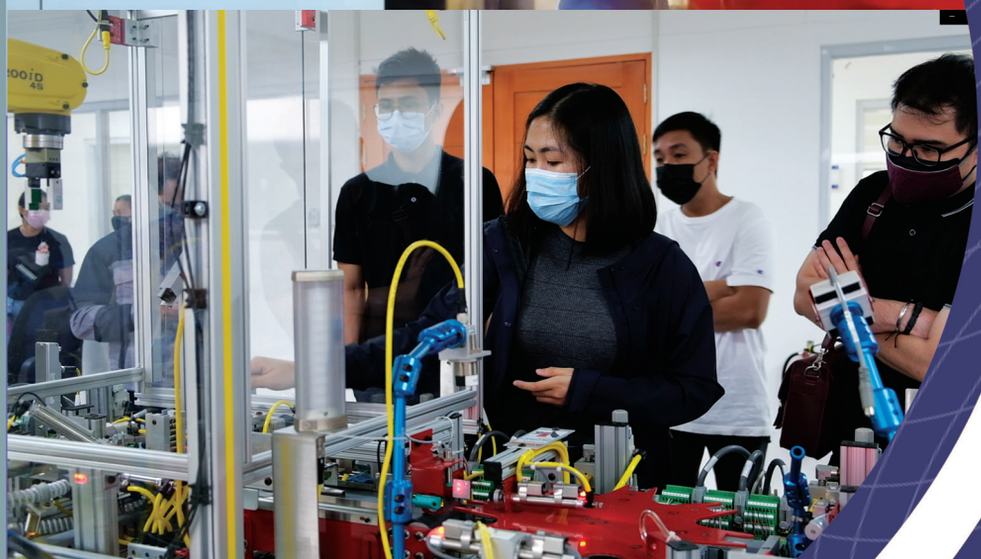
Metals Industry
Research and
Development Center

2021 ANNUAL REPORT

The Metals and Engineering Industry: Rising Above Challenges of the Times



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MESSAGE from the SECRETARY

DOST

As the country continued to face the challenges brought about by the pandemic, the Department of Science and Technology (DOST) remained faithful to its mission of ensuring that Filipinos gain optimum socio-economic benefits from all our scientific and technological efforts. This year was a meaningful year for the DOST as we played a central role in a nation that is rallying its recovery efforts. We were able to engage with major sectors of the economy and the industries that make them up through all the attached agencies.

The Metals Industry Research and Development Center (DOST-MIRDC), consistent in delivering its services with hard work and determination, is a dependable arm of the DOST. Through the DOST-MIRDC, the Department was able to reach out and collaborate with the metals, engineering, and allied industries, which are considered the backbone of the economy.

Science, technology, and innovation are undeniably among the most effective drivers of economic recovery. In 2021, the DOST-MIRDC persevered in the conduct of research and development, technology transfer, and offering relevant scientific and technical services. The Center held its doors open to the industry and stakeholders who required the use of its facilities for innovation-based product development and process streamlining activities. Truly, the Center made technology interventions available to assist the industry in recovering from the challenges caused by the pandemic.

I congratulate the DOST-MIRDC for a fruitful and purpose-driven 2021. May your accomplishments continue to enhance the productivity of the local metals, engineering, and allied industries. May your future endeavors and partnership with the industry be our way to bring the benefits of science to the people.

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

MESSAGE from the EXECUTIVE DIRECTOR

It is my privilege to present the 2021 Annual Report of the Department of Science and Technology – Metals Industry Research and Development Center.

Contained in the Annual Report are the research and development, technology transfer, and scientific and technical services accomplishments of the Center. Included also in this publication are the accomplishments of the various support groups that helped make all our successes this year possible.

In 2021, we continued to focus on agro-industrial machinery, defense and security, health, and mass transportation in our R&D initiatives. We proactively and successfully reached out to local equipment fabricators in line with our technology transfer activities. We established and launched new facilities to encourage the industry and other stakeholders to take advantage of available cutting-edge technologies for product and business innovation.

These endeavors are aimed toward bringing positive changes to the local metals, engineering, and allied industries – enhanced technological capabilities, market expansion, and business sophistication opportunities.

Driving all these accomplishments are the engineers, technicians, and support personnel who share the vision of making the DOST-MIRDC a center of excellence for competitive metals, engineering, and allied industries. Our inspiration comes from the industries

that support and collaborate with us and help make our public service meaningful and fulfilling.

Let us continue to strive for more shared accomplishments. Let us allow science, technology, and innovation to propel us toward sustained recovery and increased productivity and competitiveness.

ROBERT O. DIZON
Executive Director, MIRDC

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.

QUALITY, ENVIRONMENTAL, and INFORMATION SECURITY POLICY

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

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

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.

MIRDC 2021 PERFORMANCE REPORT

The Department of Budget and Management endowed the Center with Php226.5 million in public funds in FY 2021 to be used to translate scientific knowledge and technologies in cutting-edge metals and engineering innovations into increased benefits to Filipinos.

As a strategy to achieve this organizational outcome, the Center implements three major programs:

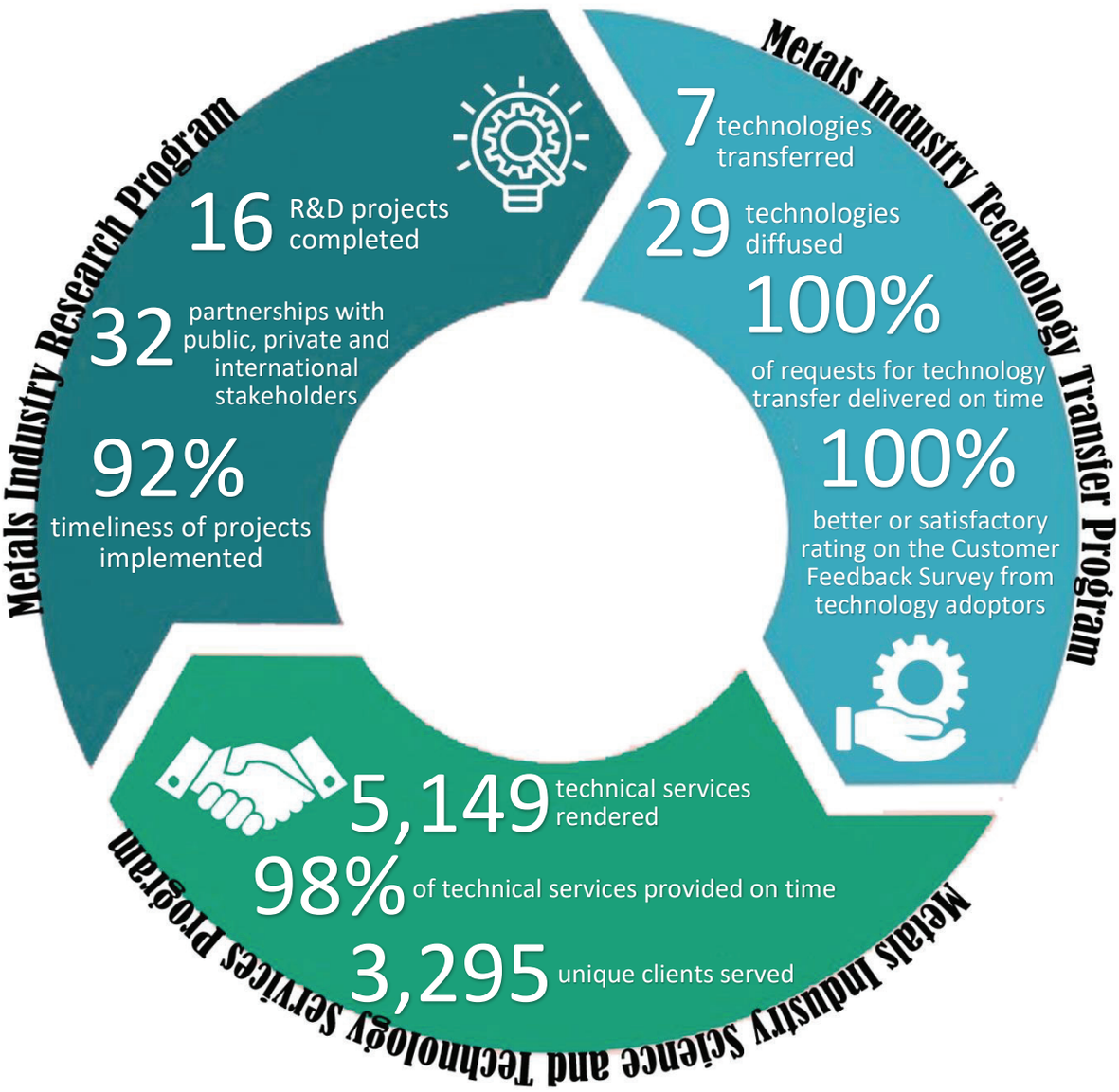
Under the Metals Industry Research Program, the Center focused its research and development (R&D) activities in the following areas: 1) Agro-Industrial Machineries, 2) Defense and Security, 3) Health, and 4) Mass Transport Systems. MIRDC completed 16 R&D projects, 92% of which were implemented on time, in collaboration with 32 partners from the public and private sectors.

The Center's Metals Industry Technology Transfer Program is aimed to fulfill the Center's mandate of conducting technology transfer, business economics advisory services, and information exchange initiatives. In 2021, 10 technology licensing agreements were undertaken to transfer seven MIRDC-developed technologies to seven technology adopters. There were 29 technologies diffused through various activities such as pitching events, webinars, industry dialogues, and virtual press conferences.

The Center also showed its resiliency and adopted through the 'new normal' of providing services to its industry stakeholders. Despite the lockdowns and quarantine protocols, MIRDC exceeded its targets under the Metals Industry Science and Technology Services Program, with 3,295 unique clients served and 5,146 technical services rendered, 98% of which were provided on time. In addition, the Center remained committed to providing professional management and technical expertise through the conduct of training for engineers, technicians, and members of the academe.

These accomplishments form part of the Center's contribution of promoting the country's economic recovery and realizing the broader goal of achieving competitiveness of the Philippine M&E industries.

MIRDC 2021 Accomplishments Based on Program Expenditure Classification (PREXC)



RESEARCH and DEVELOPMENT

COMPLETED PROJECTS

Design and Development of Automated Irrigation Controller for Organic Greenhouse

Project duration: January – June 2021
Project Leader: Isidro D. Millo
R&D Partner: Costales Nature Farms
Budget: Php 365,388.80

This project covered the design and development of an automated irrigation controller for organic agriculture. The prototype controller developed features a programmable logic controller (PLC) and a human-machine interface. The PLC was programmed to control the electric motor that drives the centrifugal pump, which supplies water to the greenhouse.

The performance test conducted at Costales Nature Farms showed significant man-hours saved by as much as 30% as compared to the manual operation of the sprinkler irrigation system. Moreover, water usage has been regulated due to the fixed amount of time allotted in the developed automated irrigation system. According to the owner, using this automated irrigation system helped them save around Php 157,000.00 per year.

Costales Nature Farm in Majayjay, Laguna.

Design and Development of Smart Deployable Food Hub

Project duration: November 2019 – November 2021
Project Leader: Isidro D. Millo
R&D Partner: DOST-CALABARZON
Budget: Php 3,391,200.00

The deployable Food Hub is a food safety-compliant food processing facility.

It can be folded for transferability and can be expanded to maximize the available space. This project was conceptualized and was implemented jointly by the MIRDC and the DOST-CALABARZON.

The development of the deployable Food Hub involved technology benchmarking, designing and preparation of technical drawings, fabrication and assembly, functional and performance testing of the prototype at the deployment site.

The fabrication and assembly of the deployable Food Hub are in partnership with Filgenius Enterprise. The deployable Food Hub was adopted by the local government unit of Magallanes, Cavite. The prototype is presently located at the new Magallanes public market.

It was inaugurated in September 2021.

Before the hub's inauguration, the testing of the coffee processing equipment housed at the deployable Food Hub started with the help of Cavite State University (CavSU).

A separate tripartite Memorandum of Agreement for the provision of guidelines, training programs, and other schemes for MSMEs in using the deployable Food Hub including the coffee processing equipment and kitchen appliances inside it was forged by DOST4A, CavSU, and LGU-Magallanes.

Setup of the Deployable Food Hub in Magallanes, Cavite.

Development of Localized Hemo-Dialysis Machine

Project duration: January – December 2021
Project Leader: Isidro D. Millo
Budget: Php 624,915.84

This project highlights the robotics and automation work of our engineers at the Advanced Mechatronics, Robotics, and Industrial Automation Laboratory (AMERIAL). The goal is to create a locally available dialysis machine. This project covers only the development of the prototype and functional testing using water.

The developed localized dialysis machine has three major components: sensors, intelligence, and actuators. The dialysis sensors provide the necessary information on the status of the blood as it flows through the machine. The intelligent decision algorithm is based on machine learning. It processes the data and provides a real-time decision. The actuators, which are motors, execute the required task.

The localized dialysis machine utilizes sensors, such as the pressure and bubble sensor. It was developed with the help of Rodrigo Jamisola Jr., Ph.D., under the Balik Scientist Program.

The machine is now ready for more tests in preparation for clinical trials.

Prototype of the Hemo-Dialysis Machine at the AMERIAL Building in MIRDC.

Design Improvement of a Riding Type Rice Transplanter Gear Transmission System

Project Duration: August 2018 – March 2021
Project Leader: Dominic S. Guevarra
R&D Partner: Rollmaster Machinery and Industrial Services Corp.
Total Budget: Php 358,830.00

The DOST-MIRDC assisted in designing and fabricating the spiral bevel gears for the power transmission of a riding-type rice transplanter through a contract research agreement with the Rollmaster Machinery and Industrial Services Corp. The transplanter was tested in a deep-mud field and showed acceptable performance in terms of durability and mobility. The gear shifting mechanism of the power transmission needs further improvement, a requirement that can easily be addressed by the design analysis and fabrication services of the DOST-MIRDC.

The Philippine Rice Research Institute (PhilRice) conducted the pilot and acceptability testing of the riding-type transplanter. Several design improvements were made on the units for deployment and testing in Visayas and Mindanao.

The project team recommends that the project implements Phase 2 for the improvements required for the power transmission and pilot test units for Visayas and Mindanao.

The design and fabrication of the gears and results of the preliminary tests generated data that may be used as references for benchmarking for the development of an improved prototype that will provide optimal gear machining solutions.

Testing of the riding-type rice transplanter of PhilRice in Nueva Ecija.

Design and Development of Metal Injection Mold for GI Hammer

Project duration: December 07, 2018 – December 31, 2021
Project Leader: Jose B. Ferrer
Funding agency: MIRDC
Budget: Php 189,309.00

Metal Injection Mold (MIM).

The DOST-MIRDC has successfully developed a metal injection mold (MIM) as shown for GI hammer, which is a component of a hand pistol manufactured and exported to the US by the Precision Foundry. The Precision Foundry, who has been producing other gun parts through investment casting, approached MIRDC for assistance to explore the metal injection process to replace investment casting. The Center handled the designing, machining, and testing of the mold while Precision Foundry supplied the fabrication materials.

GI Hammer.

BUHAWI- Building a Universal-Mount for Heavy Barrel Automated Weapon Integration

Duration: January 2019-December 2021
Project Leader: Jonathan Q. Puerto
R&D Partners: Philippine Navy (PN)
Mechatronics and Robotics Society of the Philippines (MRSP)
Budget: Y1 – 24M (DOST),
Y2 – 5M (DND-PN),
Y3 – 3.5M (DOST-PCIEERD)

The DOST and the Department of National Defense (DND) sealed their partnership through a Memorandum of Agreement on January 5, 2018 to achieve the goals of the Self-Reliant Defense Posture (SRDP) Program: to be self-sufficient in basic military requirements by manufacturing our own weapons, small arms and ammunition, tactical communications equipment, basic land vehicles, and small sea crafts, among others.

The DOST-MIRDC designed and developed the BUHAWI, an automated gun mount for Browning 0.50 caliber machine gun, M2, (Heavy Barrel), to increase the firepower capability of the Philippine Navy's (PN) small patrol crafts that defend the country's littoral water territories. This project also aims to enhance the PN's capability to counter-terrorism.

The developed automated gun mount ensures the safety of the personnel operating the machine. The development of this prototype will eventually lead to the local manufacturing of automated gun mounts in accordance with the DND SRDP.

Ultimately, robust economic activities for the local industry will be revived. BUHAWI is a tripartite partnership with the Philippine Navy (PN) and the Mechatronics and Robotics Society of the Philippines (MRSP).

BUHAWI has the following specifications (see ***specifications***) which were verified from a series of live-fire land-based testing at Camp O'Donnell in Capas, Tarlac, and Fort Reconnaissance in Ternate, Cavite and Fort San Felipe, Cavite City.

Its features also include an integrated electro-optical system with target tracking and locking and a built-in ballistic computer.

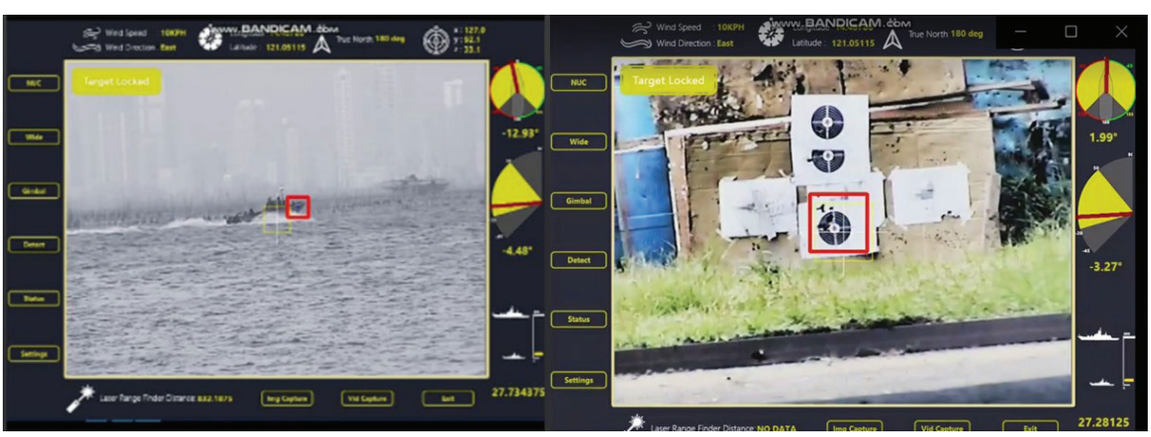
It is operated with 230 VAC with a self-sustained power supply.

Aligned with its objectives, the team conducted more than 10 training programs and trained more than 200 navy personnel on material identification and section, metalworking processes, non-destructive testing, PLC programming, and other related technologies for the operation and maintenance of BUHAWI.

Specifications:

Machine Gun Type:	Browning 0.5” HB
Gross Weight:	317 kgs
Dimension:	1313x964x866 (mm)
Ammunition:	up to 200 rounds
On Mount EO System:	CCD(Charge-Coupled Device) /FLIR(Forward Laser Infrared) /LRF(Laser Range Finder)
Angular Motion Sector:	Traverse: +135° to - 135° Elevation: +50° to - 20°

BUHAWI mounted on a trailer during live-fire testing at Fort San Felipe, Cavite City.



BUHAWI graphic user interphase (GUI) during the target tracking and locking testing at Fort San Felipe, Cavite City.

Design and Fabrication of Recoil Compensator for Cal 0.50 Caliber Heavy Barrel Machine Gun of Project Buhawi

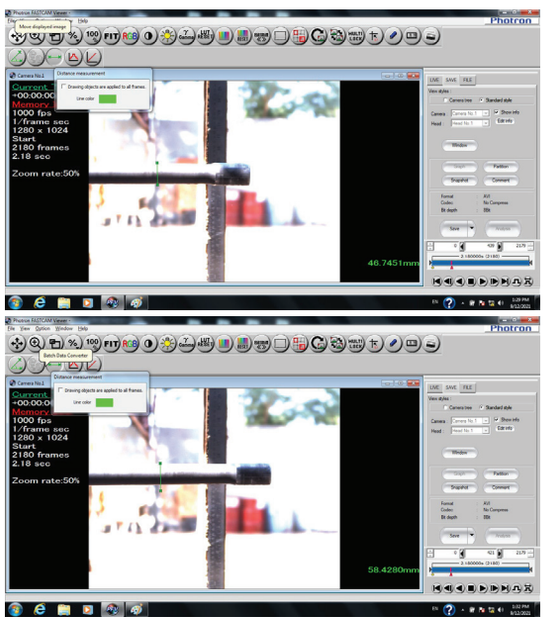
Duration: October 2021-December 2021
Project Leader: Remartin S. Maglantay
R&D Partners: Philippine Navy
Budget: Php 228,957.20

The locally-fabricated compensator prototype.

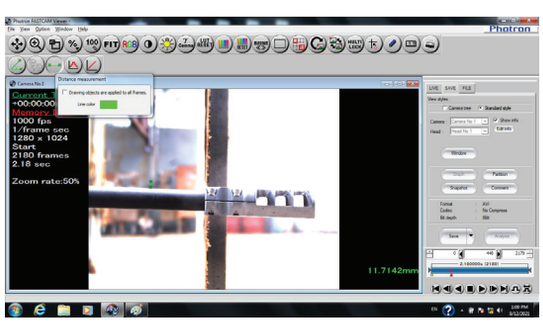
The BUHAWI project began in 2019 and to date is in the testing and debugging stage. A series of land-based live-fire testing has been conducted to test the integrity of its integrated mechanical and control system assembly.

During the last live-fire testing, the team used a high-speed camera to determine the deflection of the tip of the Cal 0.50 barrel. Single-shot firing showed a small deflection of the tip of the barrel, but when a burst of two shots was fired, a significant upward deflection was observed resulting in loss of target locking feature on the program of BUHAWI.

The result of the live-fire testing without the compensator resulted in an upward deflection of the barrel during burst fire at 48mm and 58mm respectively. Two bullets, regular and tracer-types were used.



Without compensator results taken by the high-speed camera.



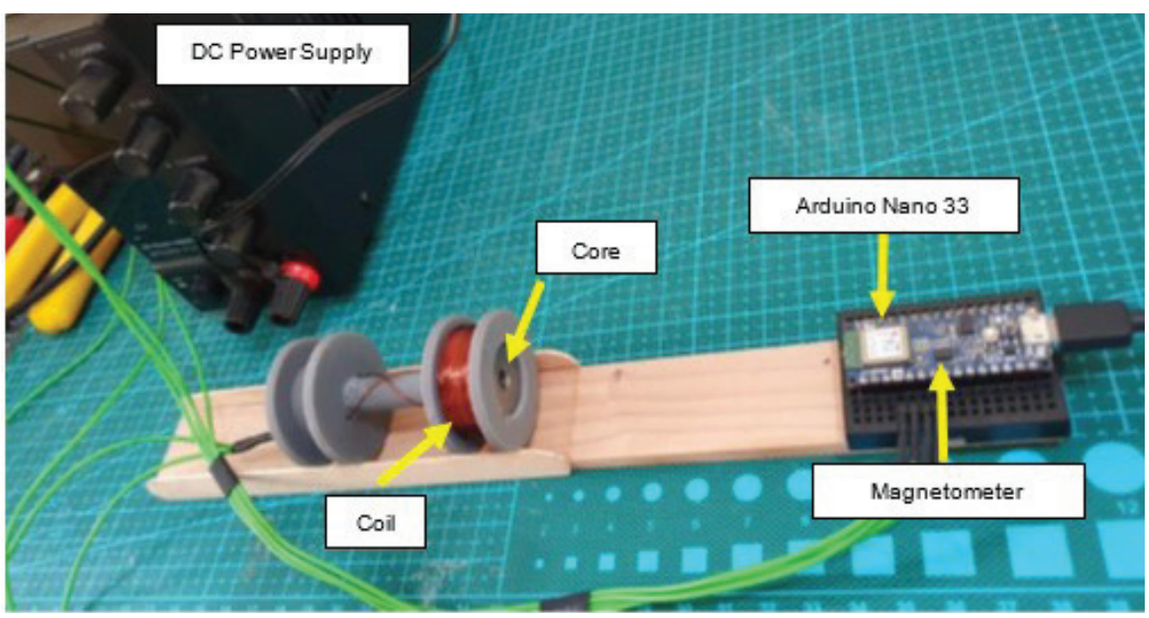
With compensator results taken by the high-speed camera.

Incorporation of the designed and fabricated recoil compensator countered the upward deflection effect during burst fire. It resulted in a downward movement with an average of 11mm.

A total of six prototypes were made, as part of the debugging process. The last prototype yielded the desired results. The entry point of the bullet and opening angle, the opening angle of the three slots on the side of the compensator were the factors considered to optimize the deflection of the barrel.

Development of Heat Treatment Process for VIM/ VAR Core Iron

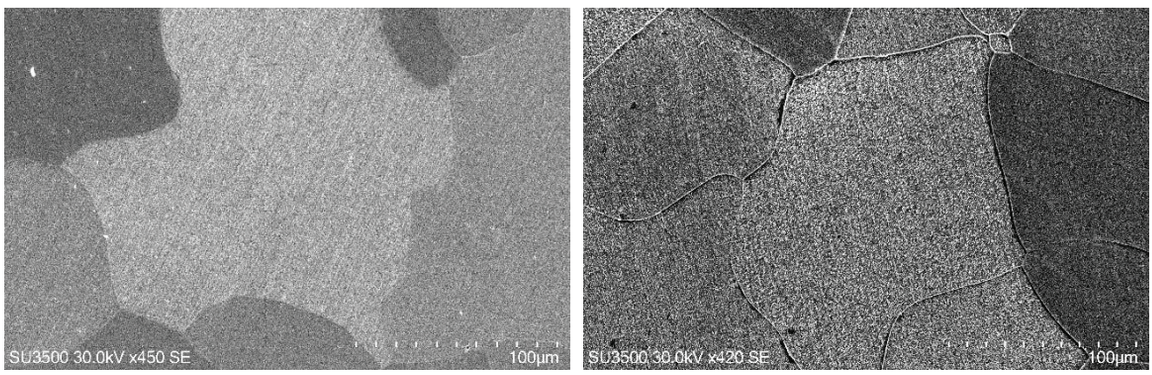
Project Duration: June – September 2021
Project Leader: Joey G. Pangilinan
R&D Partner: Orthopaedic International Inc. (OII)
Budget: Php 158,012.00



General experimental set-up consisting of DC power supply, coil, magnetometer.

The MIRDC embarked on the development of the correct heat treatment process using the vacuum furnace to attain the required magnetic property of a VIM/VAR core iron, the core material chosen by Orthopaedic International, Inc. (OII) in developing their electromagnet to be used for a surgical instrument for the treatment of leg fractures. This is in connection with the DOST-funded project titled "Development of a Magnetic Distal Targeting Device for Intramedullary Nails" being implemented by OII.

Metallographic tests conducted on heat-treated core iron showed an increase in the average grain size which is consistent with the observed decrease in hardness from 45-54HRB (untreated) to 24-25HRB (heat-treated) and a reduction in curvature of grain boundaries. These results should have been favorable in achieving the desired magnetic property as coarser grains have lesser grain boundaries which impede the movement of magnetic domain walls, and the reduction on the curvature of these grain boundaries



Images of untreated (A) and heat treated (B) VIM/VAR core iron viewed under scanning electron microscope (SEM). A reduction on curvature of grain boundaries was observed. Viewed at 450x and 420x magnification respectively.

also reduces the grain boundary energy. However, magnetic property results did not give a significant increase. It appeared that the ratio of length to diameter (aspect ratio) of the material influences the magnetic property for the required dimension. This was confirmed by conducting tests on two as-machined and two heat-treated VIM/VAR core iron with different aspect ratios (0.55 and 10).

It was concluded that the aspect ratio needed to obtain the desired magnification is beyond what is possible for their device.
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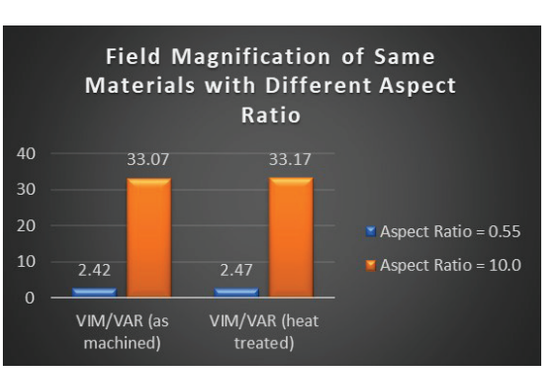


Effect of aspect ratio on field magnification of same materials.

Optimization of MPEW Cast Iron and Non-Ferrous Melting Process and Equipment for Enhanced Energy and Output Efficiency

Project Duration: September 2019 – December 2021
Project Leader: Lemuel N. Apusaga
R&D Partner: Metallic Pisces Engineering Works (MPEW)
Budget: Php 562,405.60

This project aimed to upgrade the performance of the Metallic Pisces Engineering Works (MPEW) cupola furnace used in the cast iron melting process, (i.e., to have a higher melting rate and better fuel efficiency; and, to improve the performance of MPEW crucible furnaces used in non-ferrous metal melting process (i.e., to have higher melting speed and lower fuel consumption).

For this project, the team improved the design of the cupola furnace by improving the furnace dimensions and sizing of furnace features, replacing the blower with higher pressure and flowrate type, using double row instead of the single-row tuyere, improving the tap hole and slag hole, and improving tap runner. The team also trained the MPEW foundry staff on proper cupola operation practices.

Modifications above caused a significant improvement in melting rate from approximately 120kg/hr to 1600 kg/hr, as well as in fuel efficiency from 400% to 12.5% (coke to metal ratio).

The melting speed in the new redesigned gas-fired crucible furnace was reduced from 110 minutes to 70 minutes for the same fuel rate and capacity which is a 36% improvement in both melting speed and fuel consumption. These were significantly higher than the targets of 10% for both melting speed and fuel economy.

Actual operation of improved MPEW Cupola Furnace.

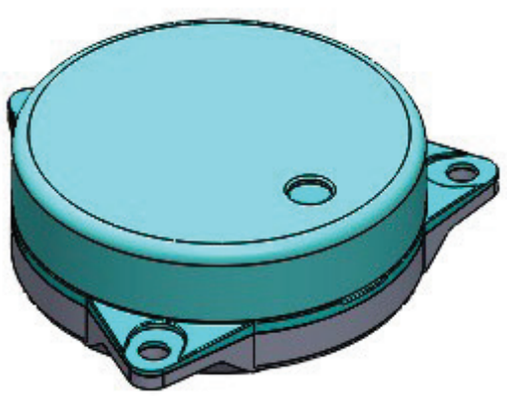
Prototype Development of Enclosure for Lightweight Observer Bluetooth Emitter

Project Duration: May – December 2021
Project Leader: Alvin M. Buison
R&D Partner: OneWatt Labs Corp.
Budget: Php 302,402.70

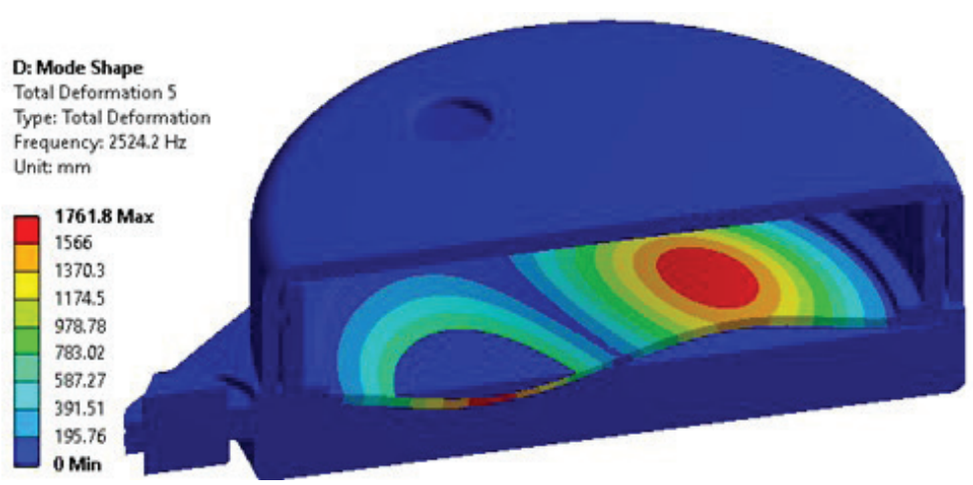
The DOST's Advanced Manufacturing Center (AMCen), in partnership with OneWatt, developed an enclosure for OneWatt's sensor by rapid prototyping using 3D printing.

OneWatt is a company that provides equipment predictive maintenance solutions by use of their sensors and proprietary AI. The Lightweight Observer Bluetooth Emitter (LOBE) is a vibration sensor that uses vibration frequencies for machinery predictive maintenance and is a compliment sensor to OneWatt's acoustic sensor, the Embedded Acoustic Recognition Sensor or EARS. For these sensors, a proper enclosure is needed to ensure the continuous function of the device.

Using simulations to do preliminary checks on OneWatt's design requirements, a prototype enclosure was designed and 3D printed using polycarbonate or PC, a material that has high thermal resistance properties and has chemical resistances relevant to the environment where the enclosures are deployed. The prototype was tested by the AMCen team simulating/following IEC 60529 for the Ingress Protection Test and EN 60079 for the ATEX test.



LOBE enclosure Prototype Design

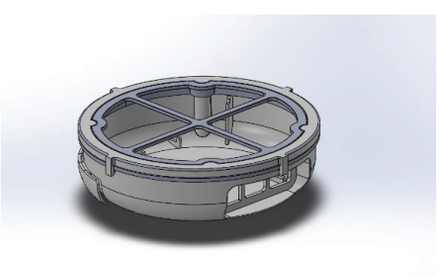


LOBE enclosure Initial Simulation

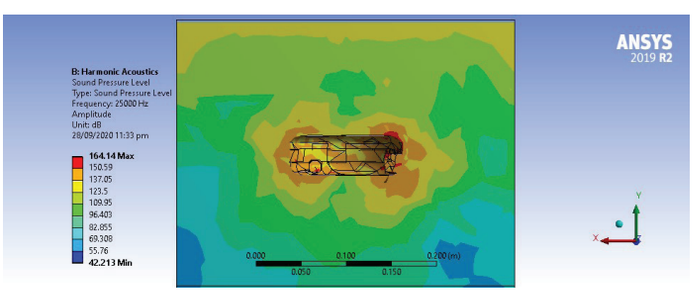
Prototype Development of Enclosure for Embedded Acoustic Recognition Sensors

Project Duration: May 2021 – January 2022
Project Leader: Ulysses B. Ante
R&D Partner: OneWatt Labs Corp.
Budget: Php 493,354.05

Another project with OneWatt is on their Embedded Acoustic Recognition Sensor (EARS), which is an acoustic sensor attached to industrial machines. EARS uses acoustic frequencies to predict and determine possible failures that may occur within the machinery. Same as the LOBE project, AMCen worked to develop OneWatt's design requirements, with the aid of simulations, using polycarbonate (PC) material which has a high thermal resistance and chemical resistance properties through fused deposition modeling (FDM) printing. The prototype design was developed, printed, and tested by the AMCen team following IEC 60529 for the Ingress Protection Test and EN 60079 for the ATEX test.



EARS enclosure Prototype Design



EARS enclosure Initial Simulation

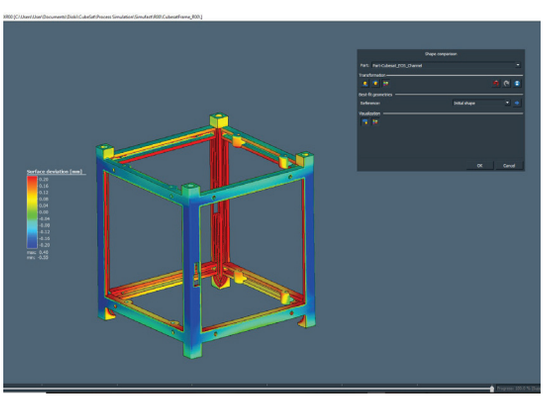
Rapid Prototyping of Cube Satellite Parts

Project Duration: May 2021 – December 2021
Project Leader: Fred P. Liza
R&D Partner: Space Technology and Applications Mastery, Innovation and Advancement (STAMINA4SPACE-PHL50)
Budget: Php 427,682.00

This project is in collaboration with the STAMINA4SPACE program of the UP Electrical and Electronics Engineering Institute to assist in the country's space exploration initiatives.

Cube satellite component prototypes were done through direct 3D printing and AM-assisted fabrication (i.e. hybrid manufacturing). Plastic components such as Nichrome wire cutting mechanism and camera baffles were 3D printed using stereolithography (SLA) technology, while the aluminum enclosure components such as cube satellite frames, star tracker

High-temperature plastic satellite components manufactured via SLA.



Lightweighting of components via generative design

electronic box, and UTACH box were fabricated directly by 3D printing using Direct Metal Laser Sintering (DMLS) technology. Stainless steel parts such as antenna deployment mechanism components were fabricated through investment casting assisted with 3D printed wax patterns using SLA printers. The materials and fabrication process in prototyping cube satellite parts were also studied. Before actual manufacturing of some components, process simulations were also performed such as generative design and metal 3D printing process simulation for the satellite frame components. The quality and performance of 3D printed parts were evaluated, including the cost-effectiveness of employing AM technology.

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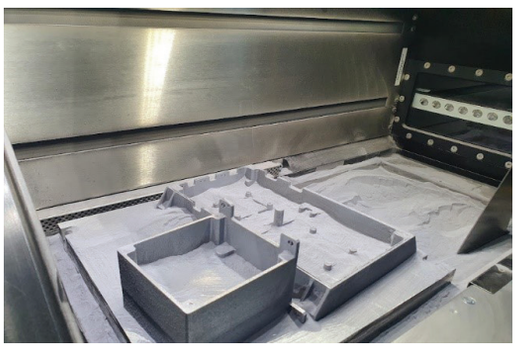
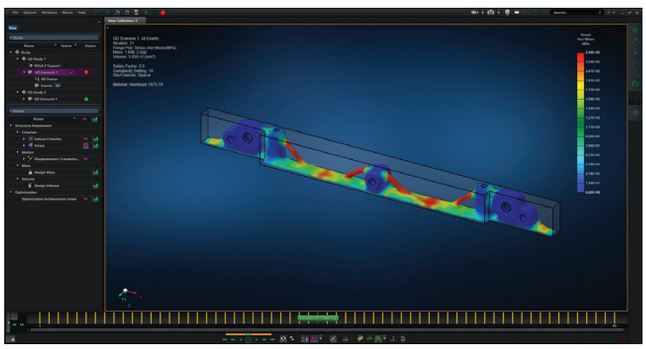
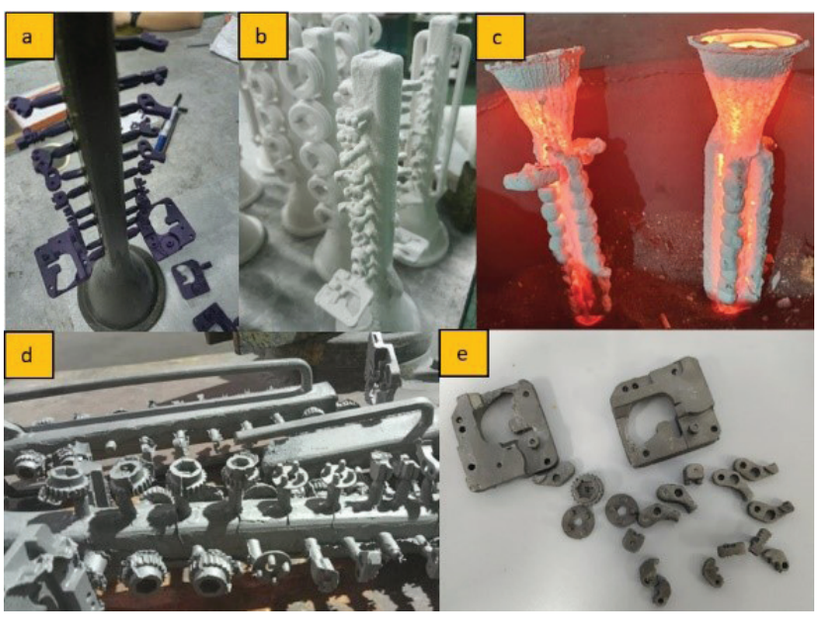


Metal 3D printing of aluminum components.



Process simulation to predict possible defects during printing.

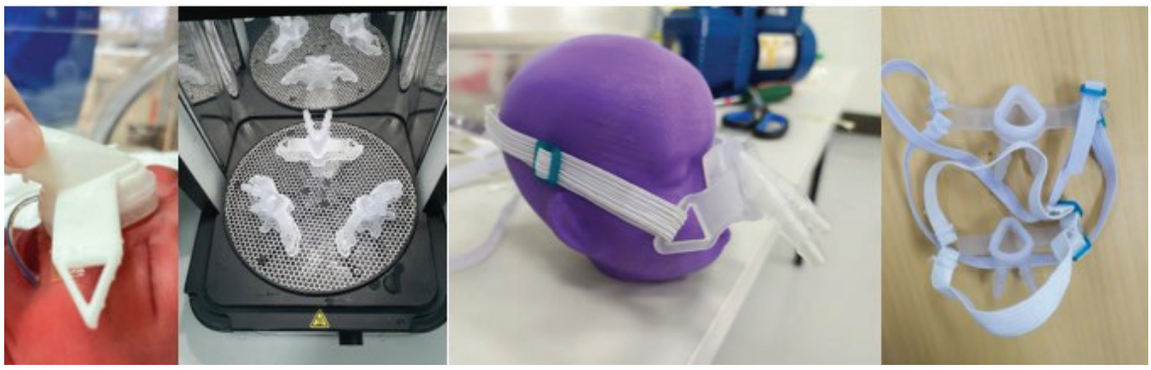


Hybrid manufacturing via investment casting using 3D-printed wax patterns.

Rapid prototyping of nasal mask for neonatal ventilation

Project Duration: May – December 2021
Project Leader: Alvin M. Buison
R&D Partner: University of the Philippines Manila – National Institute of Health (UPM-NIH)
Budget: Php 504,768.06

The development of a nasal mask suitable for use by neonate patients in need of continuous positive airway pressure (CPAP) therapy is in collaboration with the UPM-NIH. After experimenting on different materials and fabrication methods, the team developed the definitive version of the mask through the following methods: stereolithography (SLA) 3D printing of the main mask body using a biocompatible acrylate resin; and casting a food-grade silicone lip onto the rim of the mask.



(Left to Right) Initial design test fitting, revised design, revised design test fitting, nasal mask assembly.

The mask was modeled using nasal dimensions of neonates provided by UPM-NIH, and an infant's head was used as a stand-in for the checking of fit. Two nasal prongs were designed and sized for connecting to generic medical latex tubing. Two wings jutted from the base of the mask to provide attachments to two adjustable straps of a garter. Grills were added to the rim of the mask as anchor regions for the silicone lip. An accompanying one-piece mold was designed and 3D-printed to facilitate a cast-in-place procedure for the silicone. Three fit testing activities were conducted during the process, and feedback from these tests was successfully integrated into the nasal mask. Fabrication commenced with two sizes as per the UPM-NIH team, with the larger being approximately 10% larger than the other.

Copper-Nickel plating of additively manufactured polymers for high electromagnetic and radiation shielding

Project Duration: August – December 2021
Project Leader: Carla Joyce C. Nocheseda
Budget: Php 204,115.00

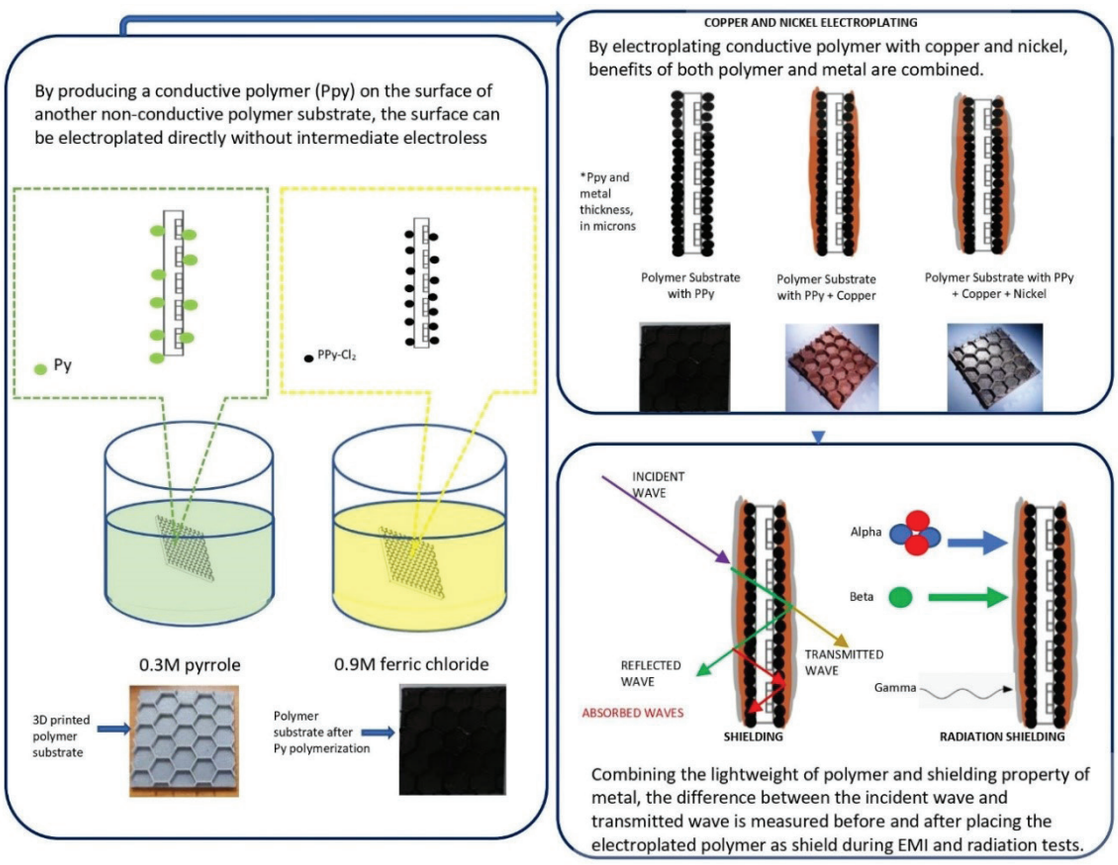
Electroplating of polymer is not new at MIRDC-DOST. Since 2012, the surface engineering laboratory has been successful in electroplating polymers, particularly acrylonitrile butadiene styrene (ABS). This is done by applying a Silver (Ag) paint using a brush so that the surface of the otherwise non-conductive substrate is altered and becomes conductive. Once the coating is dried, electroplating can proceed.

Despite the many practical advantages, this approach has little to no control over the thickness of this initial layer. This layer is preferred to be as thin as possible but can still provide an active site that will allow electroplating to occur.

In this project, the team suggested another practical way to make a non-conductive substrate conductive. This

method involved the deposition of a conductive polymer on the surface of the substrate through an in-situ chemical polymerization by dipping. The team also explained why this method is possible for ABS and how the same concept can be used to predict whether this can be possible for other common polymers that have undergone additive manufacturing.

This conductive polymer, when electroplated with copper and nickel, becomes a material that exhibits both the benefits of polymer and metal combined. The polymer was used as a shield during EMI and radiation shielding tests. The results obtained by the team after getting the difference between the transmitted wave and the incident wave show that this material may be used for electromagnetic (EMI) and radiation shielding.



Process Diagram

Effects of Machining Parameters on the Mechanical Properties of AISI 4340 Material

Project duration: January 01, 2021 - November 30, 2021
Project leader: Florante A. Catalan
Budget: Php 20,000.00

The study focused on the changes in the physical characteristics of steel when subjected to the machining process. Limited only to AISI 4340, a low alloy steel material, all samples were machined to a specified dimension for tension testing using the same turning parameters except for the depth of cut. During machining, changes in microstructures and hardness may originate from the edge of the sample since this part is the one exposed in the process of removing excess materials. Of all the tests conducted, only the tensile properties showed significant changes between the standard and the other parameters. Other available tests at MIRDC were used to further understand the changes in the tensile properties when a nonstandard parameter is used.

Characterization of Intramedullary Nails Used in the Philippines through Mechanical and Chemical Properties Determination

Project duration: August 01, 2021 - October 31, 2021;
Extension: November 01, 2021 - December 31, 2021
Project leader: Edward A. Malit
Budget: Php 580,145.00

The use of internal fixation devices is common in treating fractured long bones of the body such as the femur and tibia. The Philippine Orthopedic Center invented the Antibiotic Intramedullary Nails (ABIMN), a threaded stainless rod coated with antibiotic cement to treat such fractures and other bone infections. This product has been widely used in the country, however, there is no study if this is comparable to the standard intramedullary nails in terms of mechanical, chemical, and corrosive properties. The study determines the mechanical and chemical properties of ABIMN and compares it to the standard types of intramedullary nails, Kuntscher Intramedullary Nail (KIMN) and Intramedullary Nail with Interlocking Screw (IMNIS). Results show that the capacity of ABIMN to carry weight is recommended for limited locomotor movements only during the recovery period. Also, the pH level behaved in a similar manner compared to the two other types after 30 days of immersing the samples in a simulated body fluid.

PUBLISHED and PRESENTED WORKS

MIRDC researchers also contribute new knowledge to the science community by sharing the results and findings of studies implemented and technologies developed through publications and presentations in national and international journal and conferences.

Title of Scientific Paper Published	Authors	Peer-reviewed/ Non-peer-reviewed	Date Published	Name of Journal and Other Details
Modelling the Flow Dynamics of the Ostreavent II Using Scilab	Alexander Paran Robert O. Dizon	Peer-reviewed	March 16, 2021	IEEE Xplore
Comparative Study on using On-Off and PID-based SCR Controller on Heat Treatment of AISI 4140 Steel	Joey G. Pangilinan Geoffrey L. Abulencia Serafin G. Aguilar Ariel R. Sernal	Peer-reviewed	April 16, 2021	IEEE Xplore
Modal Analysis, Computational Fluid Dynamics and Harmonic Response Analysis of a 3D Printed X-ray Film Handler for Assistant Robotic System using Finite Element Method	Jayson P. Rogelio Leif Oliver B. Coronado Elmer P. Dadios Argel A. Bandala Ryan Rhay P. Vicerra Dino Dominic F. Ligutan Fred P. Liza Alvin M. Buison Denise Daryl A. Florante	Peer-reviewed	April 16, 2021	IEEE Xplore
3D printing of metals using biodegradable cellulose hydrogel inks	Carla Joyce C. Nocheseda Fred P. Liza Alvin Kim M. Collera Eugene B. Caldona Rigoberto C. Advincula	Peer-reviewed	October 4, 2021	Additive Manufacturing
Design and Development of a Batch Type Superheated Steam Treatment System for Stabilized Brown Rice	Dominic S. Guevarra Joein L. Luces Melvin L. Vista Rosemarie G. Garcia	Non-peer-reviewed	December 2021	Philmetals
Case-depth Uniformity of Pack Carburizing and Vacuum Carburizing: A Comparative Study	Joey G. Pangilinan Geoffrey L. Abulencia Ariel R. Sernal Serafin G. Aguilar Christian D. Brual Randy E. Songahid	Non-peer-reviewed	December 2021	Philmetals
Development of Conical Plastic Container and Packaging Box for the Improvised Explosive Device (IED) Disruptor	Denise Daryl A. Florante Vladimir M. Sarmiento Joseph Alfred V. Garcia Fred P. Liza Ulysses B. Ante Alvin M. Buison	Non-peer-reviewed	December 2021	Philmetals
Investigation of Dimensional Accuracy of a Maritime Enclosure Produced Using Additive Manufacturing	Leif Oliver B. Coronado Earl John T. Geraldo Joseph Alfred V. Garcia Marc Adrian O. Yu Anjenina U. Durana Alvin M. Buison Maria Angela B. Faustino-Lopez Jose Bernardo L. Padaca III Fred P. Liza	Non-peer-reviewed	December 2021	Philmetals
Rapid Prototyping of Column for Radiation-grafted Adsorbents for Wastewater Filtration	Jose Bernardo L. Padaca III Maria Angela B. Faustino-Lopez Johann Rafael D.B. Biscocho Alvin M. Buison Fred P. Liza	Non-peer-reviewed	December 2021	Philmetals

Title of Scientific Paper Presented	Presenter	Date Presented	Name of Conference and Other Details
Comparative Study on using On-Off and PID-based SCR Controller on Heat Treatment of AISI 4140 Steel	Joey G. Pangilinan Geoffrey L. Abulencia Serafin G. Aguilar Ariel R. Sernal	December 29, 2020	2020 IEEE 12th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM)
Modal Analysis, Computational Fluid Dynamics and Harmonic Response Analysis of a 3D Printed X-ray Film Handler for Assistant Robotic System using Finite Element Method	Jayson P. Rogelio Leif Oliver B. Coronado Elmer P. Dadios Argel A. Bandala Ryan Rhay P. Vicerra Dino Dominic F. Ligutan Fred P. Liza Alvin M. Buison Denise Daryl A. Florante	December 29, 2020	2020 IEEE 12th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM)
Design Investigations on a Two-Speed Gear Reducer for Agricultural Application	Joein L. Luces	January 14, 2021	On-line RCMEMANUE 2020 presentation with La Salle as program host
Modal Analysis, Computational Fluid Dynamics and Harmonic Response Analysis of a 3D Printed X-ray Film Handler for Assistant Robotic System using Finite Element Method	Jayson P. Rogelio Leif Oliver B. Coronado Elmer P. Dadios Argel A. Bandala Ryan Rhay P. Vicerra Dino Dominic F. Ligutan Fred P. Liza Alvin M. Buison Denise Daryl A. Florante	April 16, 2021	2020 IEEE 12th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM); Electronic ISBN:978-1-6654-1971-0 Print on Demand (PoD) ISBN:978-1-6654-2997-9; DOI: 10.1109/HNICEM51456.2020.9400014
Rice Bran Drying Kinetics of a Controlled Microwave Vacuum Dryer Optimized PLC-based: A Neuro-fuzzy Approach	Jayson P. Rogelio Elmer P. Dadios Ryan Rhay Vicerra Argel Bandala Renann Baldovino	April 16, 2021	2020 IEEE 12th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM); Electronic ISBN:978-16654-1971-0 Print on Demand (PoD) ISBN:978-1-6654-2997-9; DOI: 10.1109/HNICEM51456.2020.9400029

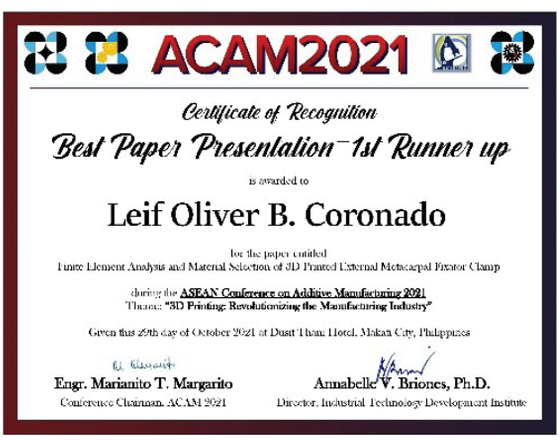
Title of Scientific Paper Presented	Presenter	Date Presented	Name of Conference and Other Details
The Robotics and the Role on Agricultural Industry in the Philippines	Jayson P. Rogelio Alvin Culaba Elmer P. Dadios Ryan Ray Vicerra Argel Bandala	April 16, 2021	2020 IEEE 12th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM); Electronic ISBN:978-16654-1971-0 Print on Demand (PoD) ISBN:978-1-6654-2997-9; DOI: 10.1109/HNICEM51456.2020.9400141
3D printing for Cube Satellites (CubeSats): Philippines' Perspectives	Michael B. de Leon Ulysses B. Ante Madelene S. Velasco Arvin Oliver S. Ng Joseph Alfred V. Garcia Fred P. Liza Rigoberto C. Advincula John Ryan C. Dizon	September 16, 2021	1st International Forum on Additive Manufacturing and Advanced Materials (IFAMAM 2021)
Additive Manufacturing Applications in Maritime Education	Elliot Gonzaga Brian J. Tuazon Joseph Alfred V. Garcia Marlon Bulan Fred P. Liza Rigoberto C. Advincula John Ryan C. Dizon	September 16, 2021	1st International Forum on Additive Manufacturing and Advanced Materials (IFAMAM 2021)
Case-depth Uniformity of Pack Carburizing and Vacuum Carburizing: A Comparative Study	Joey G. Pangilinan Geoffrey L. Abulencia	October 22, 2021	Metallurgical Conference 2021 (METCON 2021)
Flow characterization of Various Core Configurations of 3D-printed Wastewater Filter Columns using Computational Fluid Dynamics	Jose Bernardo L. Padaca III Alvin M. Buison Jordan Madrid Maria Angela Faustino Leif Oliver Coronado John Andrew Luna Patrick Jay Cabalar Joseph Alfred Garcia Laureen Ida Ballesteros Fred P. Liza	October 29, 2021	ASEAN Conference on Additive Manufacturing (ACAM 2021)
Finite Element Analysis and Material Selection of 3D-Printed External Metacarpal Fixator Clamp	Leif Oliver Coronado Ulysses Ante Johann Rafel Biscocho Carlos Emmanuel Garcia Joseph Alfred Garcia Alvin M. Buison Fred P. Liza Denise Daryl Florante Jose Bernardo L. Padaca III Eduardo Magdaluyo, Jr. Nathaniel Orillaza, Jr. Emmanuel Estrella	October 29, 2021	ASEAN Conference on Additive Manufacturing (ACAM 2021)

Title of Scientific Paper Presented	Presenter	Date Presented	Name of Conference and Other Details
Philippines Advanced Manufacturing Center: Capabilities, R&D Activities, and Future Perspectives	Fred P. Liza Joseph Alfred V. Garcia Alvin M. Buison Ulysses B. Ante Denise Daryl A. Florante Carla Joyce C. Nocheseda Maria Angela B. Faustino-Lopez Laureen Ida M. Ballesteros Jose Bernardo L. Padaca III	November 2, 2021	ASTM International Conference on Additive Manufacturing (ASTM ICAM 2021)
Cellulose Based Ink for Direct Ink Writing of Metals	Carla Joyce C. Nocheseda Fred P. Liza Alvin Kim M. Collera Eugene B. Caldona Rigoberto C. Advincula	November 2, 2021	ASTM International Conference on Additive Manufacturing (ASTM ICAM 2021)
Electroplating of Additively Manufactured Acrylonitrile Butadiene Styrene (ABS) for Material Outgassing Protection and Radiation Shielding	Carla Joyce C. Nocheseda Fred P. Liza	November 2, 2021	ASTM International Conference on Additive Manufacturing (ASTM ICAM 2021)
Modelling the Flow Dynamics of the Ostreavent II Using Scilab	Alexander Paran Robert O. Dizon	November 20, 2021	13th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management
Design and Development of Blanking Die and Forming Die of Blades of a Two-Blade Stainless Steel Propeller for Small Fishing Boat as an Alternative Stamping Tools to Manual Forming	Isidro D. Millo Ronie S. Alamon Joein L. Luces Raymond S. De Ocampo	November 26, 2021	NSTW: R&D Symposium (Virtual)
Development of Automated Irrigation System with Programmable Controller for Organic Produce Greenhouses	Franz Joseph D. Libao Robin M. Costales Nicole Ann Portia U. De Luna Michelle D. Navarro	November 26, 2021	NSTW: R&D Symposium (Virtual)
Optimization of the Control System of the Hybrid Electric Train.	Pablo Q. Acuin Geoffrey L. Abulencia Rolando F. Ibuig Marion Grejo S. Grafil	November 26, 2021	NSTW: R&D Symposium (Virtual)
Finite Element Modal Analysis and Harmonic Response of 3D-printed Vibration Sensor Enclosure	Leif Oliver B. Coronado Laureen Ida M. Ballesteros Earl John T. Geraldo Alvin M. Buison Ulysses B. Ante Jose Bernardo L. Padaca III Vladimir Sarmiento Denise Daryl A. Florante Joseph Alfred V. Garcia Fred P. Liza	November 29, 2021	13th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management

Awards Received by Technical Paper Presenters

The Center takes pride in the accomplishments of two of its most promising researchers: Engr. Leif Oliver B. Coronado and Engr. Jose Bernardo L. Padaca III, who were awarded Best Presenter first and second runner up, respectively, during the ASEAN Conference on Additive Manufacturing 2021.

Mr. Coronado presented the paper entitled, 'Finite Element Analysis and Material Selection of 3D Printed External Metalcarpal Fixator Clamp.' Mr. Padaca presented the paper entitled, 'Design and Simulation of 3D-printed Wastewater Filter Column Prototypes with Various Flow Configurations.' The conference themed '3D Printing: Revolutionizing the Manufacturing Industry,' presented a line-up of the newest studies on additive manufacturing. Through the recognition awarded to the Center's researchers, the DOST-MIRDC is able to connect and network with organizations and experts in the dynamic field of 3D printing.


ACAM2021

Certificate of Recognition

Best Paper Presentation – 1st Runner up

is awarded to

Leif Oliver B. Coronado

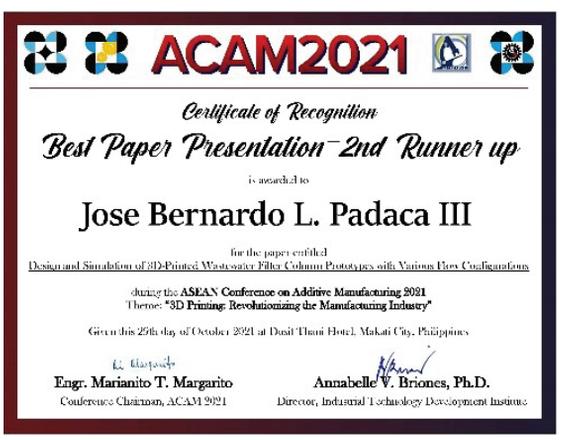
for the paper entitled
Finite Element Analysis and Material Selection of 3D Printed External Metacarpal Fixator Clamp

during the ASEAN Conference on Additive Manufacturing 2021
Theme: "3D Printing: Revolutionizing the Manufacturing Industry"

Given this 29th day of October 2021 at Dusit Thani Hotel, Makati City, Philippines

Engr. Marianito T. Margarito
Conference Chairman, ACAM 2021

Annabelle V. Briones, Ph.D.
Director, Industrial Technology Development Institute


ACAM2021

Certificate of Recognition

Best Paper Presentation – 2nd Runner up

is awarded to

Jose Bernardo L. Padaca III

for the paper entitled
Design and Simulation of 3D-Printed Wastewater Filter Column Prototypes with Various Flow Configurations

during the ASEAN Conference on Additive Manufacturing 2021
Theme: "3D Printing: Revolutionizing the Manufacturing Industry"

Given this 29th day of October 2021 at Dusit Thani Hotel, Makati City, Philippines

Engr. Marianito T. Margarito
Conference Chairman, ACAM 2021

Annabelle V. Briones, Ph.D.
Director, Industrial Technology Development Institute

INTELLECTUAL PROPERTY RIGHTS APPLICATION FILED

DOST-MIRDC researchers value and protect the results of R&D initiatives.

Title of IP File	Application No.	Date Filed	Type of Protection
A Mobile Work Station for a Collaborative Robot	32021050175	February 26, 2021	Industrial Design
A mobile Work Station with an expanded platform for Collaborative Robot	22021050209	March 11, 2021	Utility Model
Water Filter Column	3/2021/050875	September 18, 2021	Industrial Design
AMCEN TECHFEST WINNOVATION AWARDS. CELEBRATING WINNING INNOVATIONS	42020520583	December 18, 2020	Trademark

INTELLECTUAL PROPERTY RIGHTS APPLICATION APPROVED

Title of IP Granted/Approved	Application No.	Date Granted/Approved	
SUGARCANE LOADER	22017050144	Aug 13, 2020	Utility Model
CLAY JIGGERING AND JOLLYING MACHINE	32020000064	Jul 14, 2020	Industrial Design
POTTERY WHEEL	2020000065	Jul 14, 2020	Industrial Design
Hand Tractor-Attached Rice Transplanter	32020050172	Feb 17, 2021	Industrial Design
Automated Control System for Greenhouse Irrigation	N2021-01	Feb 03, 2021	copyright
HMI Program of the OstreaVent Adult Ventilator	N2021-50	Sept. 07, 2021	copyright
PLC Program of the OstreaVent Adult Ventilator	N2021-51	Sept. 07, 2021	copyright
A mobile Work Station with an expanded platform for Collaborative Robot	22021050209	Sept. 10, 2020	Utility Model
A Mobile Work Station for a Collaborative Robot	32021050175	Sept. 10, 2020	Industrial Design
Conductive Paint Composition	2/2020/050717	April 21, 2021	Utility Model
Method of Producing Ink for 3D Printing of Metallic Structures and Ink Composition of Obtainable Therefrom	2/2020/050035	May 31, 2021	Utility Model

Title of IP Granted/Approved	Application No.	Date Granted/Approved	
AMCEN TECHTUBE AM TECHNOLOGY CHANNEL 	42020520585	May 28, 2021	Trademark
AMCEN CREAT3DMINDS ACADEMY 	42020520584	May 28, 2021	Trademark
AMCEN INNOVATION GRANTS. INDUCING INCLUSIVE INNOVATION 	42020520581	May 28, 2021	Trademark
AMCEN TECH BOX. ONE-STOP-SHOP TECHNOLOGY BOX 	42020520582	May 28, 2021	Trademark
AMCEN TECH PARTNERSHAPE. ADVANCING MANUFACTURING TECHNOLOGY 	42020520579	June 11, 2021	Trademark
AMCEN ADVANCED MANUFACTURING CENTER. BEYOND THE CONVENTIONAL 	42020520577	June 11, 2021	Trademark
AMCEN CONNECT3DMINDS. EMPOWERING CONNECTED ECOSYSTEM 	42020520580	June 11, 2021	Trademark

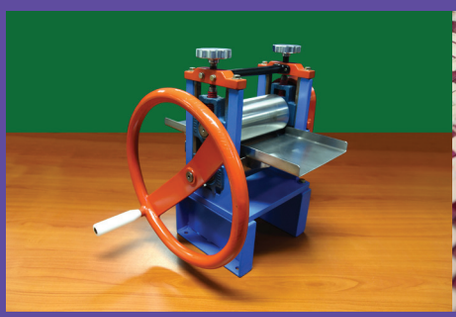
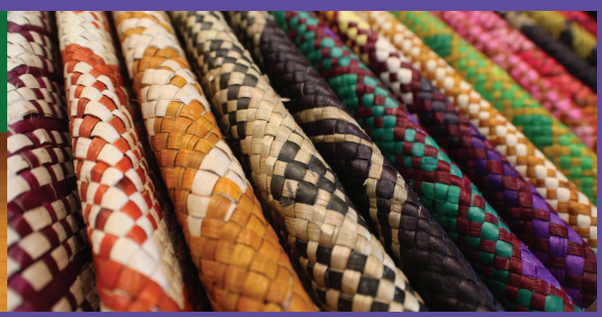
TECHNOLOGY TRANSFER and BUSINESS ECONOMICS ADVISORY SERVICES

The continuous promotion and marketing of MIRDC technologies is a task handled by the Technology Diffusion Division – Technology Advisory and Business Development Section (TDD-TABDS). The technology licensing agreements, signed by seven licensees in 2021, is a manifestation of the Center's efforts to deliver relevant R&D outputs to local MSMEs and spur vibrant business activities.

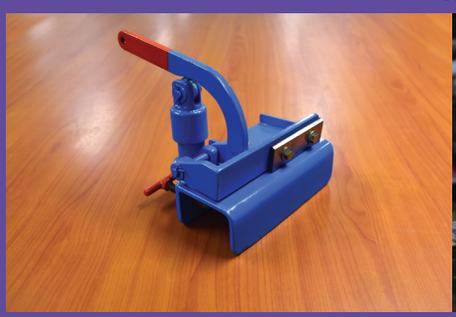
NEW MIRDC TECHNOLOGY LICENSEES

A total of seven metal fabricators from the National Capital Region (NCR), Regions II, VII, IX, and X are added to the list of licensees for the adoption of MIRDC-developed technologies – (1) Tikog Presser; (2) Electric Potter's Wheel; (3) Integrated Wrought Iron Forming Machine; (4) Vacuum Fryer; (5) Freeze Dryer; (6) Water Retort; and, (7) Abaca Fiber Extractor.

Region	Name of Licensee	Technology Adopted	Licensing Agreement Signed
NCR	1. Microcontrol Design Technology, Inc., Parañaque City, Metro Manila	Electric Potter's Wheel	February 2
NCR	2. NSB Engineering Design & Fabrication, Inc., Taguig City, Metro Manila	Vacuum Fryer	June 9
II	3. Cagayan State Univerisity – Carig Campus, Tuguegarao City, Cagayan	Vacuum Fryer Water Retort	October 25
VII	4. Ralds Trading & Electro-mechanical Services, Corp., Cebu City	Tikog Presser	January 27
IX	5. Bongbong Machine Shop, Zamboanga Sibugay	Abaca Fiber Extractor	August 24
X	6. Grecanz Trading and Engineering Services, Cagayan de Oro, Misamis Oriental	Integrated Wrought Iron Forming Machine	February 26
X	7. Eunics Marketing, Iligan City	Vacuum Fryer Freeze Dryer Water Retort	January 15 June 9 June 9

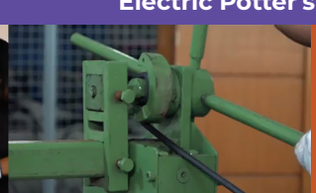



Tikog Presser




Abaca Fiber Stripper


Electric Potter's Wheel

Integrated Wrought Iron Forming Machine (iWIFE)

Vacuum Fryer

Vacuum Fryer

Vacuum Fryer

MIRDC's Technology Promotion Activities in Collaboration with DOST Regional Offices and Other Government Agencies

Engrs. Ma. Girlie M. Millo, Mervin B. Gorospe, and Rey N. Mariposque of the TDD-TABDS conducted technology pitching activities attended by IFWD and DTI-Kalinga beneficiaries, LGU in Ilagan, Isabela, NDDRMC / DOST Region 1, House of Representatives, and M&E industry personnel. Discussed during the pitching sessions are the different technologies developed by the MIRDC researchers – their applications, benefits, and market potentials.

Additional potential adopters from among the attendees and increased awareness of the MIRDC-developed technologies were the results of the said technology pitching sessions.

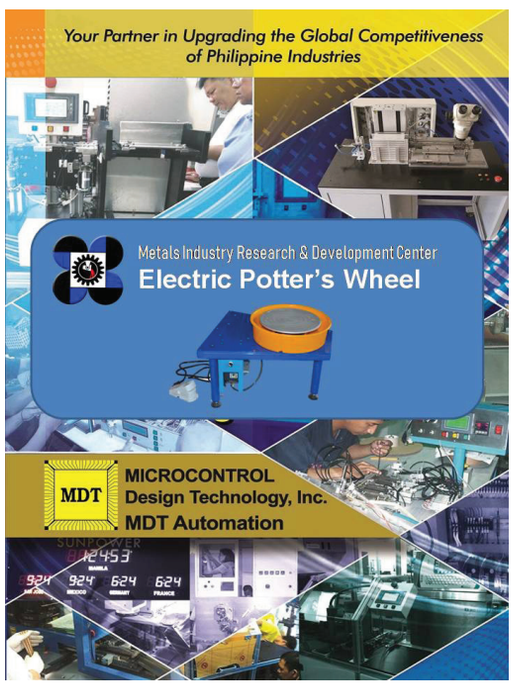
The various MIRDC-developed technologies promoted through pitching.

BUSINESS ECONOMICS ADVISORY SERVICES

Scale-up Collaboration Continues with Emerging and Simple to Set Up Electric Potter's Wheel

The MIRDC partnered with Microcontrol Design Technology, Inc. (MDT), an industrial automation company providing innovative product solutions to manufacturing requirements, for the licensing of the Electric Potter's Wheel through an agreement signed on February 2, 2021.

Within the year, the MDT has fabricated and delivered a total of three (3) units of the Electric Potter's Wheel for the beneficiaries of the Department of Trade and Industry's project in the province of Antique. The adoption of the said technology shall increase the livelihood of the people of Antique, open start-up firms, enliven the pottery industry, and strengthen the MSMEs.



The Microcontrol Design Technology, Inc. has successfully sold 3 units of MIRDC-developed Electric Potter's Wheel.

Improvement of Granulator of Muscovado Process Leads to Increase in Productivity and Profit

The Lanayon Sugarcane Milling firm in Laua-an, Antique, a DOST-Small Enterprises Technology Upgrading Program (DOST-SETUP) beneficiary, was assisted by Engr. Felipe Pachoco last September for the improvement of the granulator for muscovado processing. The objective is to have a uniform granular quality of muscovado products.

Engr. Pachoco introduced an improved design of granulator that can produce finely granulated muscovado which can be sold at PhP80.00/kg. With the adoption of the new design of

The improved design of granulator introduced to Lanayon Sugarcane Milling firm in Laua-an, Antique.

granulator, the Lanayon Sugarcane Milling is expected to earn an additional PhP50.00 for every 2kg. sale of muscovado since its current granulator can only produce lumps sold to sugar-based food processors at PhP30.00/kg.

DOST-MIRDC Provides Consultancy Services to Other DOST Line Agencies in Line with Re-certification of ISO 9001:2015 Quality Management System

In the quest of the National Academy of Science and Technology (NAST), Science Education Institute (SEI), Science and Technology Information Institute (STII), and Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD) to successfully received an ISO 9001:2015 re-certification, several technical consultancy services were availed from the DOST-MIRDC on the following areas:

- ISO 9001:2015 Clause-by-clause Requirements
- Risk Management Process based on ISO 3100:2018
- Upgrading Competencies of Internal Quality Auditors
- Root Cause Analysis and Corrective Actions
- Remote Audit versus Onsite Audit
- Effective Implementation of 5S in the Workplace

DOST Agencies which successfully passed the ISO 9001:2015 re-certification of their Quality Management System in 2021.

DOST-MIRDC Forges Partnership with the Light Rail Manila Corporation (LRMC)

DOST-MIRDC signified its support to the Light Rail Manila Corporation (LRMC) through the virtual signing of the Memorandum of Understanding last April 21, 2021. The MOU paved way for the technical experts of MIRDC to collaborate and work closely with LRMC in exploring possible activities for the conduct of structural repairs of specific light rail vehicles (LRVs) and local re-engineering and/or fabrication of LRV spare parts that are obsolete and/or difficult to source. It also proves true of the Center's mandate to assist the metals, engineering, and allied industries.

Site inspections in the LRMC depot and nondestructive testing of the LRV unit were conducted as initial activities.

NON-R&D PROJECTS

The Center also engages in non-R&D projects. In 2021, DOST-MIRDC continued the implementation of several non-R&D projects. The outputs of the said projects will strengthen the Center's scientific and technical services, resulting to more relevant and focused technology-based services that will better mold the future of the metals industry.

Establishment of the Metals and Engineering Innovation Center (MEIC) in the Cordillera Administrative Region (CAR), and Regions I, II, III, and X.

After the successful launching of the MEIC in the vicinity of Ifugao State University (IFSU), Don Mariano Marcos Memorial State Univerisity – La Union (DMMMSU), Cagayan State University (CSU), Nueva Ecija University of Science & Technology (NEUST), and University of Science and Technology of Southern Philippines (USTP), series of webinars, demonstration, and hands-on activities were conducted for the upgrading of competencies on R&D of faculty staff and the effective operation of MEIC. The output of the webinars is the fabrication of an A-frame to be used as material handling equipment. Then, purchase, delivery, and installation of various machines, i.e. press brake, shearing machine, furnace, etc. were performed by the accredited suppliers and witnessed by the MEIC project members and contract of service staff.

MEIC ongoing training

MEIC Facilities

At the start of the second year of the project, review, deliberation, and approval of proposed R&D projects utilizing the MEIC facility by the SUCs were conducted. The ongoing implementation of the approved projects is being monitored by the MEIC project staff.

MTSC building perspective, Gen. Trias, Cavite City.

Establishment of the Mold Technology Support Center

The ongoing MTSC will support the advancement and growth of the local die and mold industry by developing human resources for the die and mold companies, and consequently advancing the competitiveness of the country's manufacturing industry.

The MTSC facility is currently being constructed at the Cavite Economic Zone in Gen. Trias, Cavite. In 2021, there were 42 trainings conducted both in-person and online platform with a total of 2,048 participants. The resource speakers were the technical experts of MIRDC in the field of technical drawing, mold design, mold process, mold assembly, and other related fields. An expert from the Korea Association of Machinery Industry (KOAMI) served as a resource speaker for 7 webinars

Strengthening the S&T Technical Services in the National Capital Region (NCR) Through Capacity-Building on Metals and Engineering (DOST-NCR Project)

As manufacturing gives a significant contribution to the growth of the gross domestic product (GDP), the DOST helps MSMEs to boost their productivity and competitiveness by availing services offered by the SETUP. SETUP is one of DOST's flagship programs aimed at encouraging and assisting MSMEs to adopt technology innovations to improve their operations.

The objective of this project of the DOST-NCR project is to strengthen the DOST-NCR and SETUP beneficiaries' project management to enhance technical capabilities through technology and skills training on equipment design/metals and engineering. The project is designed with two components: (1) general training programs; and (2) seminars/ workshops/skills training programs.

The DOST-MIRDC is involved in the project implementation as the Center is responsible for the delivery of the following project outputs: Development of training modules per session; conduct of 20 general training programs - four non-technical and 16 technical programs (Component 1); conduct of 10 seminars/workshops/skills training programs - four non-technical programs and six technical programs (Component 2); conduct of one trainer's training program; and quality improvement of products/processes of stakeholders.

In 2021, the MIRDC was able to conduct five webinars to a total of 138 participants from different MSMEs in the NCR.

SCIENTIFIC and TECHNICAL SERVICES

ANALYSIS and TESTING

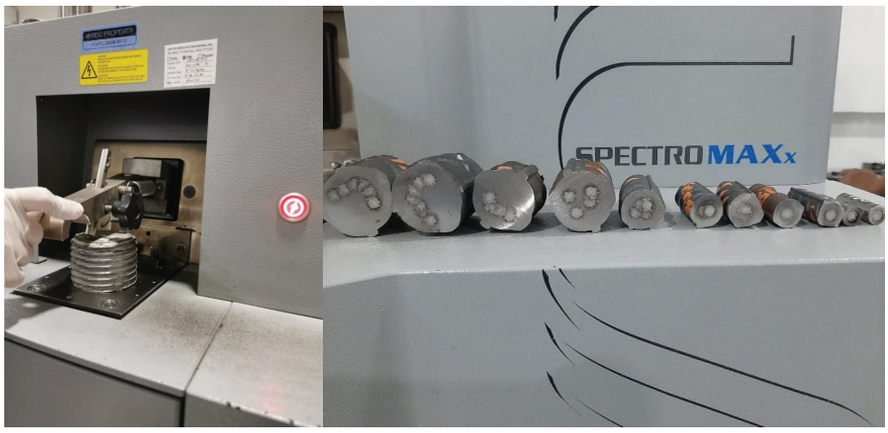
The MIRDC's Analysis and Testing Division (ATD) continuously delivers quality testing and calibration services to the local metals, engineering, and allied industries amidst the pandemic. The ATD's laboratory personnel serve as front liners responding to the calibration and testing needs of various industries, especially the metals industry.

Testing is recognized to be one of the most sought technical services of the industry, making the ATD an important partner of the industry and a significant contributor to the MIRDC's accomplishments in 2021.

DOST-MIRDC Extends Continued Support to the PRRD's Flagship program "Build Build Build"

The Mechanical Metallurgy Laboratory (MML) continuously provides testing services to projects under the current administration's flagship program "Build, Build, Build" including Metro Manila Subway, LRT2 Extension, Bridge Projects, and the recently opened Metro Manila Skyway Stage 3 that connects the SLEX and NLEX. Numerous samples used in various projects were tested to ensure the quality and safety of the materials.

Some samples tested by the Mechanical Metallurgy Laboratory (MML) under the ATD's Physical Laboratories Section (PLS) supervised by Engr. Florante A. Catalan for the "Build, Build, Build" program of the government.



Testing of hexagonal bolts and deformed bars by the ATD's Physico-Chemical Laboratory and Corrosion Laboratory under Analytical Laboratories Section (ALS) supervised by Engr. Gina A. Catalan for the "Build, Build, Build" program of the government.

ATD's Physical Laboratories Section (PLS) supervised by Engr. Florante A. Catalan supports the LRT1 Expansion to Cavite project which is part of the "Build, Build, Build" program of the government.

ATD's PLS also supports the Continuing PUV Modernization Program of the Department of Transportation (DOTr).

DOST-MIRDC Supports the Department of Public Works and Highways (DPWH)

The Metrology Laboratory's new standard, the Comparator GBCD-100A, can calibrate grade 0 steel and ceramic up to 0-100mm. Utilizing this new standard, the DOST-MIRDC's Metrology Laboratory catered to the calibration needs of the Department of Public Works and Highways-Bureau of Research and Standards (DPWH-BRS) to ensure that laboratory tests and measuring equipment conform to ISO/IEC 17025:2017 standards specification requirements and comply with the requirements of regulatory agencies. The DPWH-BRS laboratories for accreditation to the ISO/IEC 17025:2017 include the Asphalt Testing, Cement Testing, Mechanical Testing, Soils and Aggregates Testing, Miscellaneous Materials Testing, and Glassware and Thermometers. The services of the ATD's calibration experts are tapped by the DPWH-BRS through a Memorandum of Agreement with DOST-MIRDC.

The Instrumentation Laboratory also conducted in-plant calibration at the Materials Testing Division and Research and Development Division of the DPWH-BRS in line with the ISO.IEC 17025:2017 accreditation.

Dimensional measurement of test sieves with the Metrology Laboratory's New Comparator GBCD-100A that can calibrate grade 0 steel and ceramic up to 0-100mm.

Republic of the Philippines
Department of Science and Technology
FOOD AND NUTRITION RESEARCH INSTITUTE

presents this

CERTIFICATE OF APPRECIATION

to

GINA A. CATALAN

for sharing her expertise and invaluable inputs as
Internal Quality Auditor
during the
2021 Internal Quality Audit
of the DOST-FNRI Nutritional Genomics Laboratory

Given this 24th day of November 2021
at Bicutan, Taguig City, Philippines

IMELDA ANGELES-AGDEPPA, Ph. D.
Director IV and Scientist II

Fight Malnutrition with Accurate Data, Correct Information and Innovative Technologies

Engr. Gina A. Catalan served as an Internal Quality Auditor in the Food and Nutrition Research Institute (FNRI) for Nugen Laboratory last November 2021.

Instrumentation Laboratory conducts in-plant calibration at the Department of Public Work and Highways (DPWH)'s Bureau of Research and Standards testing laboratories.

DOST-MIRDC Supports Department of Trade and Industry (DTI) Programs in Promoting Quality and Safety Products

The DOST-MIRDC, through ATD personnel, supports the DTI-PAB activities. Engr. Rommel N. Coroña, Engr. Arlene G. Estacio, Engr. Florante A. Catalan, Engr. Gina A. Catalan, Engr. Christian M. Ibañez, Engr. Christine P. Avelino, and Engr. Arvin Yan V. Pacia approved signatories, render their services as technical assessors and experts in the field of testing and calibration.
Aside from the regular calibration jobs, the IMS performs Measurement Audit as a reference laboratory with the participating calibration laboratories for them to maintain their ISO 17025:2017 accreditation. IMS was able to provide measurement audits to various local calibration laboratories with different parameters this year.

The Testing Laboratory personnel were also involved in the formulation of Philippine National Standards, used for the mandatory requirement for materials and products prior to consumer use. There are currently six (6) Technical Committee members in ATD, namely Engr. Florante A. Catalan (TC 44 – Road Vehicles), Engr. Gina A. Catalan who acts as the Vice-Chairman for (TC54 – Jewelry), (TC61 – Ferrous Pipes and Fittings), Ms. Jo Marie Venus T. Agad (TC54 – Jewelry), Engr. Karl Andrew S. Chavez (TC 44 – Road Vehicles), Engr. Christian Glenn S. Ligon (TC86 – Ships and Marine Technology and TC on PNS/DOE FS 2: 2008 LPG Refilling Plant), and Engr. Edward A. Malit (TC 06 – Gas Cylinders). These standards were thoroughly reviewed periodically by stakeholders and committee members coming from the industries, academe, private companies, manufacturers, and government institutions.

The ATD also engages in advocacies to support and promote Laboratory Quality Management System and Safety Products.

ATD's Instrumentation and Metrology Section Maintains its Philippine Accreditation Bureau (PAB) Certificate of Accreditation

To ensure and continuously maintain the laboratory management system and competence of the laboratory in accordance with the standard PNS/ISO 17025:2017 (General requirements for the competence of testing and calibration laboratories), the Philippine Accreditation Bureau of the Department of Trade and Industry (DTI) conducts scheduled audits in the ATD's laboratories. The scope of the accreditation in the field of calibration includes Length, Pressure, Mass, Force, Torque, Electrical, Temperature, Humidity, and Ultrasonic Thickness, all are calibration capabilities that have continued to maintain the MIRDC clients' confidence since 1996.
The 1st Surveillance Audit of the IMS' Instrumentation Laboratory and Metrology Laboratory, held by the PAB audit team consisting of recognized Technical Assessors on June 21-22, 2021, is one of the ATD's major accomplishments for the year.

Re-issued 2020 PAB Certificate of Accreditation granted to MIRDC's Mechanical Testing and Chemical Testing have Certificate Validity until January 2023. For Calibration, validity is still November 11, 2020, and the new certificate is expected to be issued until February 2022.

Analysis and Testing Division (ATD)'s ISO/IEC 17025:2017 Scope of Accreditation

Implementation of streamlining activities in compliance with RA 11032

Ease of Doing Business

The ATD contributed to the DOST-MIRDC's compliance with the Republic Act 11032 or the Ease of Doing Business Act by updating the requirements in the Citizen's Charter. The ATD provided a complete checklist of requirements and identified a simplified step-by-step procedure in processing a testing and calibration job.

The ATD also ensures unhampered service in issuing Test and Calibration Certificates, by reducing the number of signatories which was implemented last November 2021.

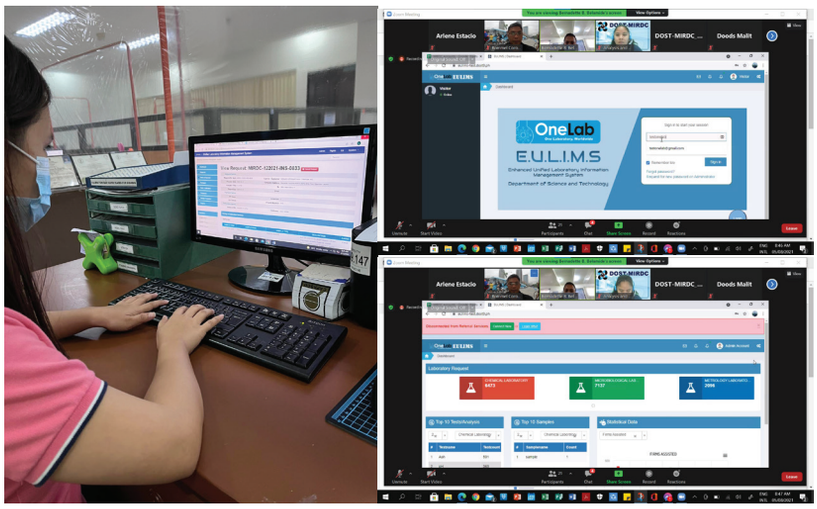
Reduced processing time

The ATD implemented strategies to reduce the overall processing time of its services. The centralized business area of the ATD utilizes the Unified Laboratory Information Management System (ULIMS), which eliminates the redundant processes required by the laboratories in processing the technical service request. An online tracking system is also implemented for the customers to monitor the status of the job anytime.

The continued implementation of the ULIMS greatly improved the processing in the receiving and releasing of testing and calibration samples in ATD. The benefits from this ONELab project include future online booking for customers, electronic payment through Landbank or Paypal, and a referral system.

Paperless calibration process

The Center continuously implements a paperless calibration process, making the paperless operation of selected instrument calibration possible. This practice also allows the Center, through the ATD, to release calibration reports and certificates faster. This initiative is under the MITHI project.



An orientation on the use of the OneLab Enhanced ULIMS was conducted last August 05, 2021.

TECHNICAL SERVICES

Technical Solutions Services Section (TSSS) Contributes to Overall Accomplishments in 2021

Although business has been very tough for the metals industry sector this year, the Technical Solutions Services Section (TSSS) was able to serve 197 technical service requests (TSR) and generated an income from external services equivalent to two million pesos. The services were combined efforts of the MIRDC's metalcasting, machine shop, and heat treatment units.

The utilization of the Center's machines was improved. The TSSS achieved its 9000-hours utilization target from external and internal jobs.

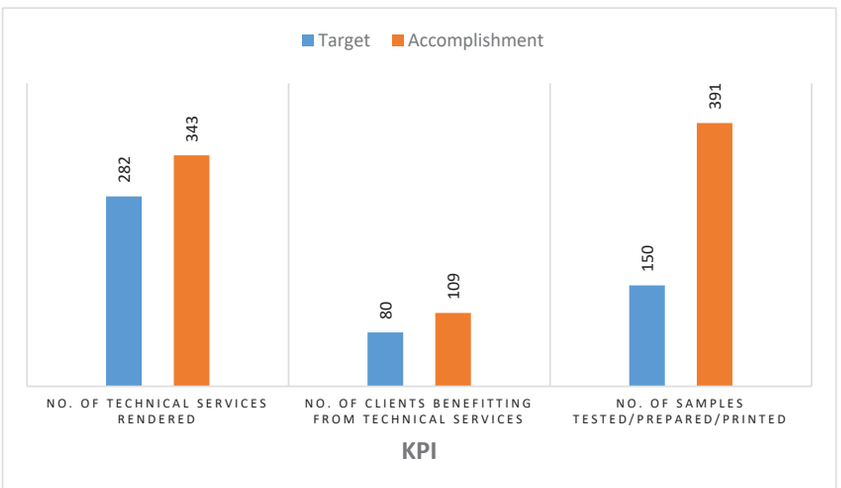
The 5S program was also implemented within the metal fabrication area to optimize the man-hours of staff, organize job execution and ensure the work safety of personnel. Fabrication of welding booths was also conducted during this activity.

Skills upgrading of staff through in-house training was conducted to fill in the positions vacated by employees who availed of early and compulsory retirement.

(L-R) 1. A joint meeting with MOCG addressing concerns of Mc Cormick's 'Pakform Food Saucen Die; 2. Preparing the dewaxed PNRI's 'link items' for investment casting process; and 3. Inspection of Eunics Marketing's 'macerator roller' prior to delivery in Iligan City.

R&D Group Delivers Technical Services to the Industry

Aside from research and development outputs, MPRD provided various technical services. Shown in the graph below are the targets and accomplishments of different key performance indicators.



INDUSTRIAL TRAINING

The DOST-MIRDC continuously fulfills its mandate of supporting the metals, engineering, and allied industries by providing the industries' workforce with training through the expertise of the Center's technical staff. The Industrial Training Section's (ITS) accomplishments made a significant contribution to the MIRDC's overall output in response to the needs of the industry and other beneficiaries of the Center's services.

The DOST-MIRDC surpassed the year's target of 158 training programs. Through ITS the Center conducted a total of 182 training both in-person and via the online platform.

The Center offers regional, regular, and packaged programs. Regional training programs are offered for free and cater to diverse clients including students in different regions of the country. Regular and packaged programs are paid training programs that are usually attended by the workforce of different companies in the metals, engineering, and allied industries.

In 2021, the ITS conducted 178 (97%) webinars to a total of 14,327 participants; and two packaged and two regular training programs to a total of 96 participants.

The ITS continuously caters to its clients by conducting trainings in different areas of specialization. As presented in Table 1, the highest number of trainings conducted was in the area of metalworking which includes welding programs, metal fabrication, heat treatment of steels, and machine shop operations, among others.

Table 1. Distribution of Training Programs Conducted According to Area of Expertise and Location (CY 2021)

Areas of Expertise/Region	NCR	CAR	I	X	TOTAL
Analysis and Testing	23				23
Engineering, Production and Planning	12				12
Management/Productivity Improvement	13				13
Metal Casting Technology	5				5
Metalworking Technology	91	1	1	1	**94**
Others	35				35
Total	**179**	**1**	**1**	**1**	**182**

Experts from various divisions of the MIRDC served as resource speakers for MIRDC's technical seminars and webinars. The ATD experts who conducted the training programs on Industrial Calibration, Dimensional Metrology, and Uncertainty of Measurements are Engr. Rommel N. Coroña, Engr. Arlene G. Estacio, Engr. Arvin Yan V. Pacia, Mr. Myro Jon M. Baroña, Ms. Christine P. Avelino, and Mr. Eduardo V. Diasanta, Jr.. The training assistants are Mr. Luisito N. Alcantara, Mr. Samuel A. Ysit, Ms. Mary Joy R. Baroña, and Mr. Luis C. Forbes, and resource persons in the field of analysis and testing of metals are Engrs. Florante A. Catalan, Gina A. Catalan. From the Materials and Process Research Division (MPRD), AMCen key personnel like Engr. Joseph Alfred V. Garcia and Engr. Denise Daryl A. Florante, and surface engineering personnel like Ms. Keziah M. De la Rama also served as resource speakers. Resource speakers from PD on the training programs under the Mold Technology Solution Center (MTSC) were conducted by Engr. Francis C. Dime, Engr. Arby F. Coria, Engr. Jenny C. Velasco, Engr. Salvador T. Gelilang, Mr. Mike Andrew I. Alfaro and Mr. Walter V. Bonggat. Training programs on Advanced Mechatronics, Robotics and Industrial Laboratory (AMERIAL) were conducted by Ms. Nicole Ann Portia U. de Luna, Mr. Kim Paulo S. Orquia, Ms. Michelle D. Navarro, and Mr. Vincent Boy E. Manabat while Engr. Ronie S. Alamon also served as a resource speaker in the field of metalworking. From the TSSS are Engr. Edilbert M. Dela Peña and Engr. Florentino J. Dela Fuente who conducted training programs on metalworking and foundry practices. Other experts from TDD who served as resource speakers are Mr. Reynaldo L. Dela Cruz, Jr., Ms. Ma. Girlie M. Millo, Engr. Mervin B. Gorospe. Engr. Rey N. Mariposque, Mr. Adonis T. Marquez and Mr. Osric Primo Bern A. Quibot.

MIRDC's Training Programs Made Impact in the Industry

The Center gathers feedback from training participants to measure the benefits they gained. Participants of eight-hour training programs are sent survey questionnaires after three months, while those who attended training programs with more than eight hours of duration are sent survey questionnaires after six months.

Impact assessment conducted for eight-hour training programs and more than eight-hour training programs revealed that 75.7% and 66.6% of training participants, respectively, reported having gained high impact in terms of enhanced knowledge. Details of the impact assessment are presented in Tables 2 and 3.

Table 2. Impact Assessment of Trainings with a Maximum Duration of 8 Hours

Impact Indicators	Level of Impact						No Impact	NA	Total Responses
	High	%	Medium	%	Low	%			
Enhanced knowledge	1,685	75.7	527	23.7	11	.005	0	2	2,223
Enhanced Skills	1,451	61.7	837	35.6	11	.005	0	2	2,348
Improved Attitude	1,580	67.3	734	31.3	28	.011	3	5	2,345
Transferred knowledge	1,528	65.0	764	32.5	45	.019	8	5	2,350

Table 3. Impact Assessment of Trainings with a Duration of More than Eight Hours

Impact Indicators	Level of Impact						No Impact	NA	Total Responses
	High	%	Medium	%	Low	%			
Enhanced knowledge	4	66.6	2	33.3	0	-	0	0	6
Enhanced Skills	7	43.7	9	56.2	0	-	0	0	16
Improved Attitude	7	43.7	9	56.2	0	-	0	0	16
Transferred knowledge	8	50.0	8	50.0	0	-	0	0	16
Reduced Production Cost	7	43.7	16	43.7	0	-	0	0	16
Increased Production/ Sales/Services	8	50.0	8	50.0	0	-	0	0	16
Improved Product/ Service Quality	9	56.2	7	43.7	0	-	0	0	16
Developed New Products/Services	8	50.0	8	50.0	0	-	0	0	16

INFORMATION and PROMOTION

The Center engages in information exchange activities to disseminate advocacy programs, results of its R&D outputs, updates of technology transfer initiatives, and services of existing and newly-established facilities. This is carefully and strategically executed by the Center through the Technology Diffusion Division – Technology Information and Promotion Section (TIPS).

2021 Metals and Engineering Week

The Center spearheaded the celebration of the 2021 Metals and Engineering (M&E) Week on June 14-18, 2021. Bannered by the theme 'The Metals and Engineering Industries: Rising Above Challenges of the Time,' the Center joined hands with industry players to celebrate successes and inspire collaboration of the stakeholders despite and amid the pandemic.

During the entire week, the Center conducted various activities: a Virtual Talakayan; launching ceremonies for the Advanced Manufacturing Center (AMCen) and the Advanced Mechatronics, Robotics, and Industrial Automation Laboratory (AMERIAL); presentation of the Metals and Engineering Innovation Center (MEIC) capabilities; and webinars featuring the Mold Technology Support Center (MTSC) project and the Center's industry partners – Aerospace Industries Association of the Philippines (AIAP), Mechatronics and Robotics Society of the Philippines (MRSP), Metalworking Industries Association of the Philippines (MIAP), PDMA, Inc., and the Philippine Welding Society (PWS).

2021 Metals and Engineering Week

DOST key officials, led by Secretary Fortunato T. de la Peña (center), grace the launching of the AMCen facility on June 14, 2021.

AMCen Grand Launching

The AMCen is one of the first government-led additive manufacturing (AM) centers in the ASEAN. The launching and inauguration of the AMCen on June 14, 2021, was attended by 30 guests onsite and 300+ Zoom participants, and accumulated over 2,400 Facebook views. The event formally opened the doors of the AMCen to the public, making available its technologies for services and fostering more collaborations.

AMCen MOU and MOA Virtual Signing Ceremony with Partners

This event, held on June 15, 2021, aimed to seal the partnership between AMCen and various sectors to create an ecosystem composed of different sectors such as academe, technology innovators, regional offices, technology partners, and industry. In this ecosystem, everyone is encouraged to collaborate with one another, with AMCen at the core. The event had 11 academe partner signees, seven technology partner signees, and three 3D printing service provider partner signees.

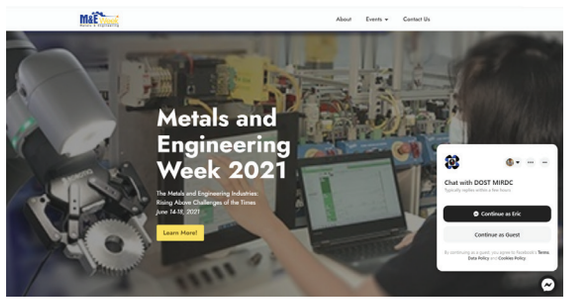
AMERIAL Launching

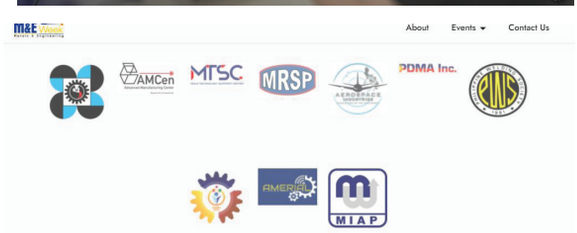
The launching of the AMERIAL served to open the facility to potential clients and industry partners. Included in AMERIAL's technology portfolio are the Smart Factory, Collaborative Robot, Automation Studio, and the mechatronics kit. All these are offered to strengthen the technology upgrading efforts of MSMEs and assist them as they embrace Industry 4.0.

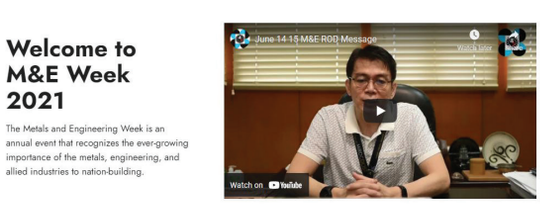
Unveiling of the AMERIAL marker led by DOST Sec. Fortunato T. de la Peña and MIRDC Exec. Director Robert O. Dizon.

Metals and Engineering (M&E) Week 2021 Website

All these activities for the M&E Week were made accessible to the public through the M&E Week website created by the Center through the PMD-Management Information Section. The website was launched in June 2021 with the primary objective of providing a one-stop portal access for the M&E and allied industries, partner agencies, students and the general public to a free access on webinars conducted by the Center's technical experts and with participation of resource speakers from the M&E associations.







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2021 National Science and Technology Week

DOST-MIRDC actively participated in the 2021 NSTW. The Center's activities for the NSTW focused on the theme 'Agham at Teknolohiya: Tugon sa Hamon ng Panahon.'

Attuned to the needs of the industry, especially during the very trying times due to the continued Covid-19 pandemic, the Center featured several projects to elicit the industry's support and encourage involvement in these projects' present and future activities: industrial automation of micro, small, and medium enterprises through the AMERIAL, shift to efficient mass transportation in the city of Ilagan

Activities of the DOST-MIRDC for the 2021 National Science and Technology Week.

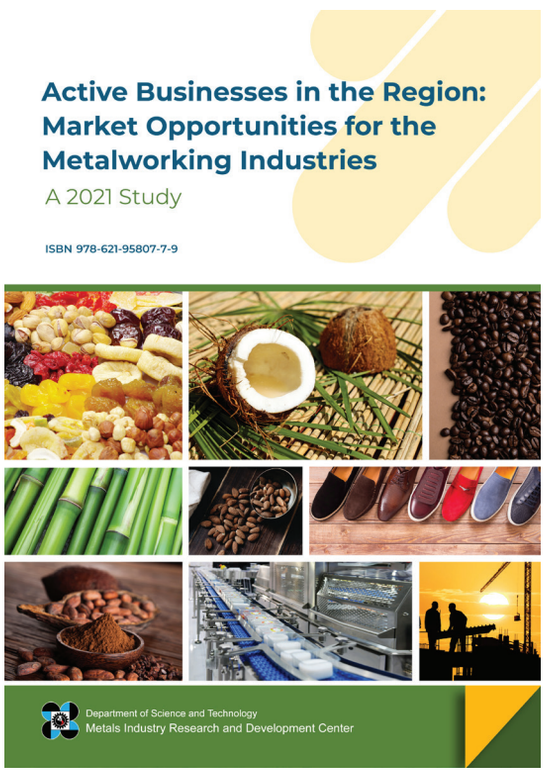
through the Hybrid Electric Road Train (HERT), and rapid prototyping and innovative product development through additive manufacturing technologies offered by the AMCen. Also part of the 2021 NSTW celebration is the Metals, Engineering, and Allied Industries R&D Symposium where MIRDC researchers presented their technical papers covering various topics to the industry and the academe.

Industry Study

The Industry Research and Study Unit (IRSU) of the TDD-TIPS embarked on a study in 2021. Unlike the usual industry studies conducted by the Center, the respondents of the 2021 industry study are active frontline industries – those which managed to remain in business despite the restriction brought about by the pandemic. The Center was able to interact directly with representatives from the shoe industry in the NCR, fruits and nuts industry in Region VI, and coconut, cocoa, and cacao industries in Region XI.

From the responses of the frontline industries, the Center was able to determine certain areas where there may be business opportunities for the metals industry. The IRSU engaged MSMEs in consultative meetings relative to the implementation of the industry study. There was an industry dialogue held on March 12, 2021, where the MIRDC, through the IRSU, solicited the insights of frontline industry players to further improve the survey instrument. At the end of the survey initiative, the Center called for a focus group discussion (FGD) on October 28, 2021. In the FGD, the preliminary results of the survey were presented to the frontline industry players as well as to the metals industry.

The industry study further brought the metals industry closer to the frontline businesses, specifically the shoe industry in the NCR through the two business-to-business meetings

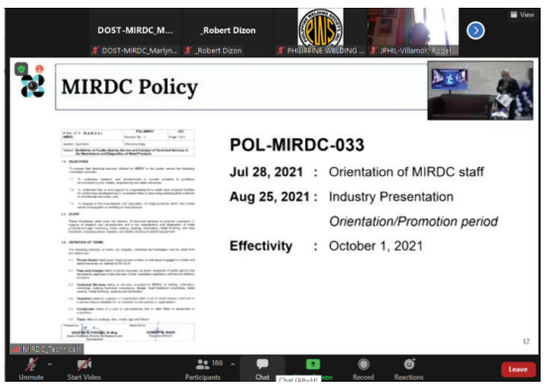


DOST-MIRDC developed a publication as an output of the 2021 industry study.

conducted, with the participation of the Metalworking Industries Association of the Philippines (MIAP) and the DOST-National Capital Region (DOST-NCR) personnel. The series of interactions served to provide avenues for interaction and business discussions that may potentially strengthen industry linkages.

In a nutshell, the 2021 industry study was able to bring the metals industry closer to frontline businesses, where market requirements and opportunities will further be explored.

New Guidelines in Facility Sharing and Technical Services

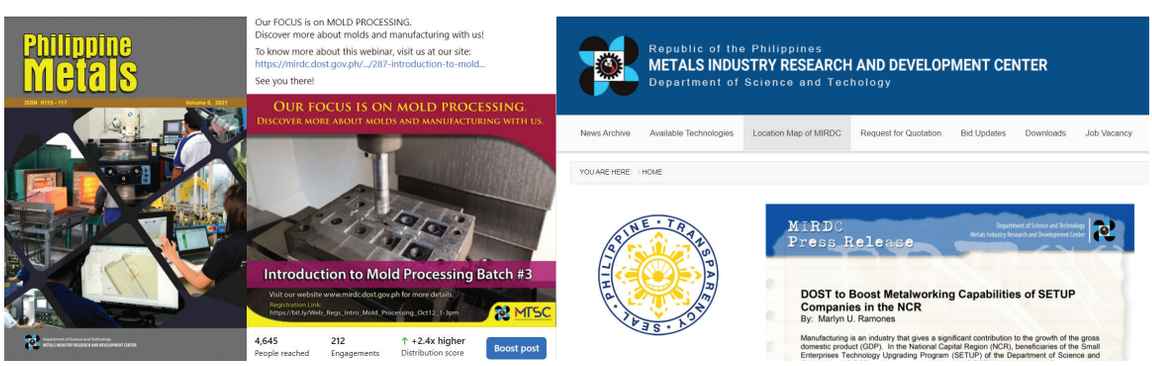


The DOST-MIRDC formulated a new MIRDC Policy for facility sharing and technical services as an initiative to better serve the metals, engineering, and allied industries. The new guidelines cover technical services such as testing, calibration, metrology, training, technical consultancy, design, heat treatment, machining, metal casting, metal finishing, welding, and fabrication. The systems and procedures are usually based on the Center's collaboration with the industry as they are intended to maximize the industry's utilization of the DOST-MIRDC facilities.

The new guidelines were presented through an industry dialogue on August 25, 2021 which was attended by 187 participants from the different industry associations, academe, and government.

DOST-MIRDC's information, education, and communication (IEC) materials optimize the reach of social media

Proactive in disseminating information regarding the Center's R&D outputs and scientific and technical services, the DOST-MIRDC produced IEC materials and took advantage of the reach of social media to boost information campaigns.



(L-R) Philippine Metals 2021; invitation to a webinar posted on the official Facebook page; and press release posted in the DOST-MIRDC website.

Media Engagement

The Center continues to partner with media friends to widen the reach of promotion and advocacy initiatives.

OTHER ACCOMPLISHMENTS CRUCIAL to MIRDC'S REMARKABLE PERFORMANCE in 2021

PLANNING and MANAGEMENT DIVISION (PMD)

PMD-Planning and Evaluation Services

The PMD, in coordination with the Management Committee, monitored organizational performance to ensure that annual targets are achieved. To serve this purpose, the PMD facilitated three planning sessions for CY 2021.

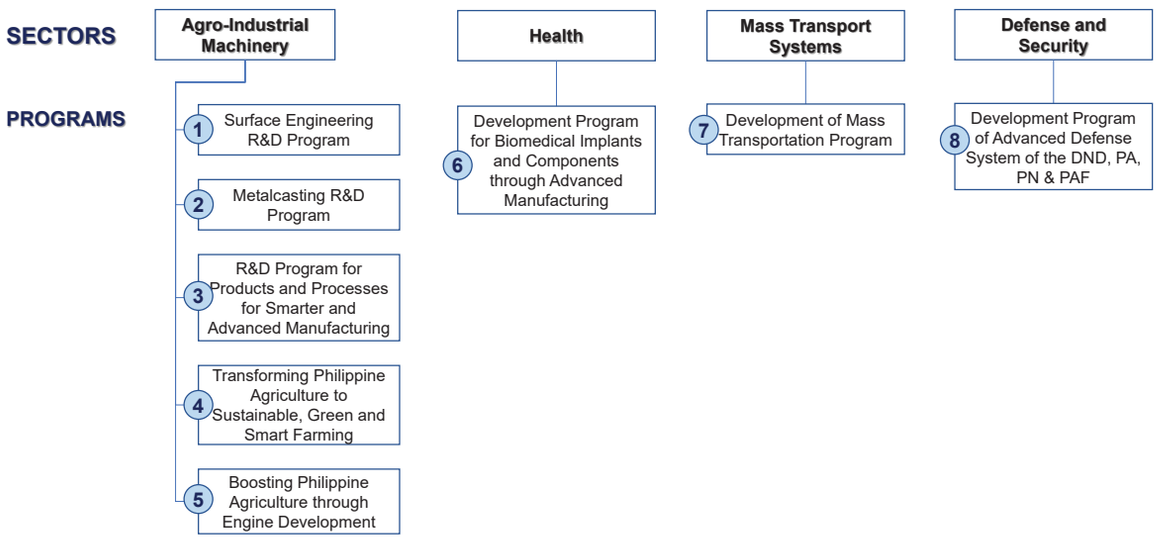
1. Mid-Year Review and Planning (MYRP)– July 22-23, 2021 via Zoom platform
2. Quarterly Review and Planning (QRP) – October 6-7, 2021 via Zoom platform
3. Year-end Review and Planning (YERP) – December 9-10, 2021 via Zoom platform

Through the planning sessions and deployment of plans and programs of the Center, delivery units and personnel are able to express their concerns as well as suggest how operations in MIRDC can be further improved. The discussions and exchange of ideas further instill stewardship and accountability.

The PMD took part in crafting the Long Term R&D Plan which shall serve as a foundation for the MIRDC's programs and activities as it aligns with the prevalent technological trends anchored to the Philippine Development Plan (PDP) 2017-2022 and the Harmonized National R&D Agenda.

Eight programs were identified under the four sectors prioritized for the Center's R&D and these are: 1) Surface Engineering R&D Program; 2) Metalcasting R&D Program; 3) R&D of Products and Processes for Additive Manufacturing; 4) Transforming Philippine Agriculture to Sustainable, Green and Smart Farming; 5) Boosting Philippine Agriculture through Engine Development; 6) Development Program for Biomedical Implants and Components through Advanced Manufacturing; 7) Development of Mass Transportation Program; and 8) Development Program of Advanced Defense System of the DND, PA, PN & PAF). The Long Term R&D Plan serves as a bedrock for the Center in creating strategic mechanisms to ensure that it provides more relevant innovation outputs to the metals and engineering sector.

8 R&D Programs of MIRDC



PMD-MIS

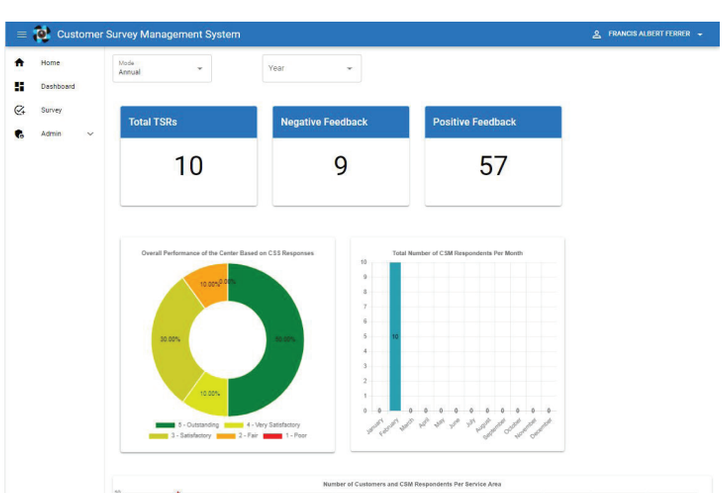
ICT Infrastructure Management

The MIS played a big role in the establishment of the network infrastructure in the two facilities of the Center: the AMERIAL and the AMCen. This activity was made possible because of the Php 10.8 million budget from the Medium-Term Information and Communications Technology Harmonization Initiative (MITHI) project. The MIS further enhanced the existing infrastructure in various facilities of the Center with activities such as creating a new network layout for better visibility and connectivity, re-cabling, and upgrading of software and equipment.

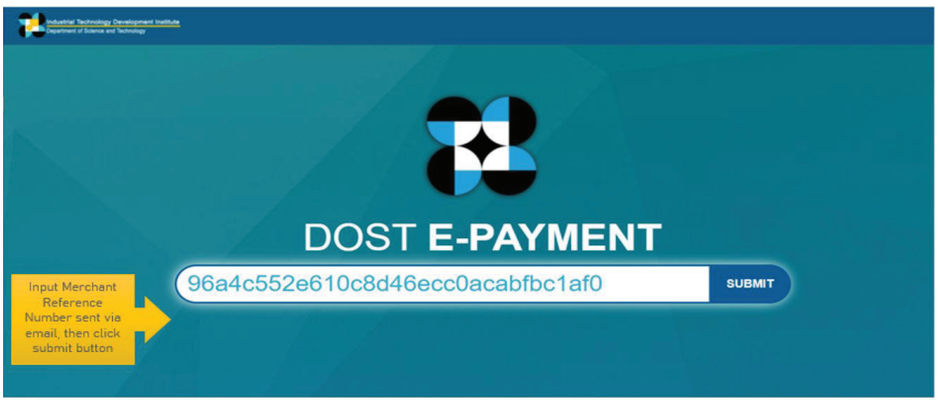
Information Systems Completed

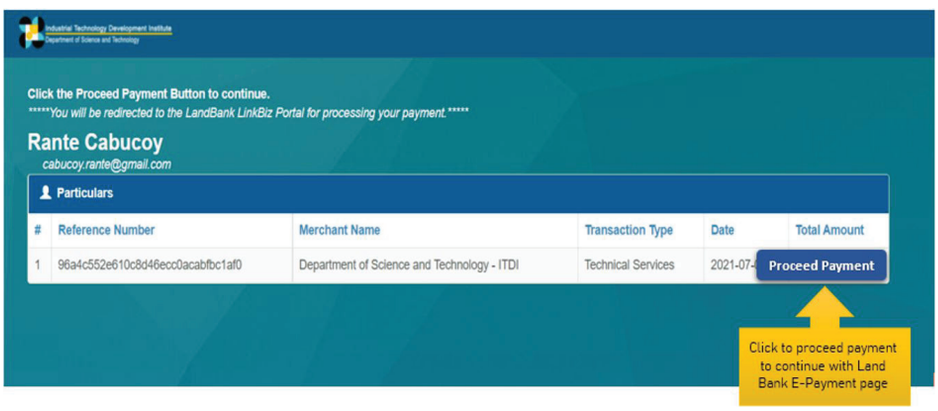
Customer Satisfaction Survey Management System (CSMS)

The CSMS is a web-based and access-controlled system that gathers feedback from customers served by the Center. The data shall be analyzed and used as a basis in further improving the Center's services.



The system provides the end-user with useful analytics from the data gathered to help with the overall feedback evaluation of the Center's services.





E-Payment Integration to Frontline Systems

The integration of an E-payment portal to our frontline systems was made possible by a partnership with DOST-ITDI thru a Memorandum of Understanding (MOU). The said portal has been tested with AMCEN Online Integrated System (AIOS). With this, online cashless transactions are promoted, reducing the risk of spreading COVID-19 in the midst of the pandemic.

The integration of e-payment shall continue with other existing MIRDC info systems, as follows:

1. OneShop
2. OneLab

Enhanced Information Systems

Enhancement of information systems used by the Accounting, Property, and Technology Solutions Services groups support the operations and efficient frontline services for the customers.

A total of three information systems were upgraded:

1. Budget Management Information System (BMIS); with cash utilization / LDDAP requirement.
2. Property and Procurement Management System (PPMS); with enhanced module for PAR / ICS and Inventory report.
3. OneShop; a new version with a new database framework and enhanced user interface design.

FINANCE and ADMINISTRATIVE DIVISION (FAD)

MIRDC Human Capital

The DOST-MIRDC has a total of 208 technical and non-technical filled up positions by the end of 2021. This created an 88.88% sustained human resource-based from its 234 approved plantilla positions. This also included several manpower movements that resulted in the conferment of one newly hired personnel and 13 employees separated from government service.

Currently, MIRDC employs a total of 53 engineers, 87 technical, and 68 non-technical personnel under the three directorates of the Center, namely: Office of the Executive Director, Research and Development, and Technical Services. The workforce is broken down as follows:

	Office of the Executive Director			Research and Development		Technical Services	
	OED	PMD	FAD	MPRD	PD	ATD	TDD
Engineers	3	0	3	12	14	13	8
Non-Engineers (Technical)	1	12	0	17	22	20	15
Admin/Support/Non-Technical	2	4	37	4	11	3	7
TOTAL	6	16	40	33	47	36	30

Note: based on DBM Plantilla level of positions

Learning and Development: Adapting to the Challenges of e-platform

The Center's Learning and Development (L&D) Program was successfully implemented resulting in a 96.77% accomplishment of the Annual Learning Development Plan for CY 2021.
The FAD-Administrative and General Services (AGSS) Staff Development Unit surpassed its 85% target despite the ongoing pandemic. Recipients of these L&D Programs were 161 personnel: 60% are male and 40% are female per gender population of the Center.

The FAD-AGSS Staff Development Unit was able to cope with the "New Normal" set-up of its learning and development activities using an online platform. All related processes were enhanced in adopting the E-learning activities and were in line with the requirements of the documented Quality Management System (QMS). Because of pressing and continuing challenges during the pandemic, the FAD-AGSS continually evaluates and evolves its processes to keep abreast of the changing business/ operation requirements.

Scholarship Program

As the nation slowly recovers from the effects of the pandemic, the Center continues its effort to upgrade its workforce's capability. For the year, three employees completed their master's degree through the Department of Science and Technology – Human Resource Development Program (DOST-HRDP) scholarship grant. Likewise, two new scholars were admitted to pursue their respective master's degrees.

Health and Welfare Programs

The Center participated in health and wellness programs such as the blood-letting activities in March and in December 2021, and the participation in the national vaccine roll-out themed 'Resbakuna: Kasangga ng Bida.'

The FAD-AGSS, in coordination with the local government unit of Taguig City, a total of 188 employees and 42 contractor personnel were successfully vaccinated for their first and second dose shots for increased protection from the Corona Virus. The said program, which was conducted in five batches, kicked off on June 1,4, 2021, and culminated on November 17, 2021. By the end of the year, a total of 290 regular and contract service personnel, which makes 98% of the workforce population of MIRDC, were fully vaccinated.

(Left) The donors during the assessment and screening of the Red Cross team (vital signs taking, blood typing, and testing). (Right) The employees with Engr. Robert O. Dizon during their first and second dose of COVID-19 vaccination at Vista Mall and Lakeshore Taguig.

2021 MIRDC Virtual Celebrations

Virtual gatherings were made possible with the conscientious effort and cooperation of the Management, FAD-AGSS, and PMD-MIS. Other employees aside from those present thru the Zoom platform were also able to view the event in real-time through Facebook

First, the virtual Employee's Day celebration was held last June 18, 2021, with the theme "MIRDC @ 55: Celebrating the Feats of Excellence."

To cap off the year, a virtual Thanksgiving Celebration was held last December 17, 2021, with the theme "FUNDemya: Laugh Together, Hope Together...Masaya Kung Sama Sama."

Both programs included recognition of outstanding employees and those who served in the government for a significant number of years by the PRAISE Committee and raffle draw lots which made the employees happier and even more excited. Indeed, there is joy and mirth to be found amidst the challenges as we recognize the blessings we receive and the effort of one another in achieving our common goal, and that is becoming one in our purpose to give exemplary service.

MIRDC Financial Resource Management

In adherence to the president's call to ensure that the 2021 budget be used to support all current and future government actions to recover the economy, the Center recalibrated its navigational route to provide better and more attuned programs and projects to serve the needs of its primary stakeholders and partners, with an end view of redounding to the benefit the Filipino people.

Given the limited fiscal space or the available funds, the budget was prioritized to ensure that the Center is focused on the delivery of its mandated goods and services, and in achieving its key performance indicators, without sacrificing the health and the lives of its workforce.

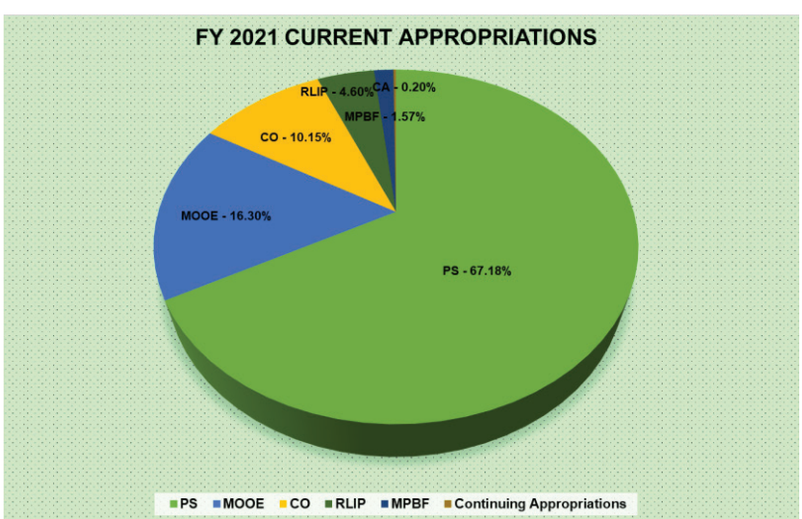
Regular Fund: Source and Utilization

Allotment and Obligation

The DOST-MIRDC has total new appropriations of ₱ 226,524,000.00. This figure is comprised of Personnel Services (PS), Maintenance and Other Operating Expenses (MOOE), and Capital Outlays (CO) for the Center's programs to achieve its organizational outcomes.

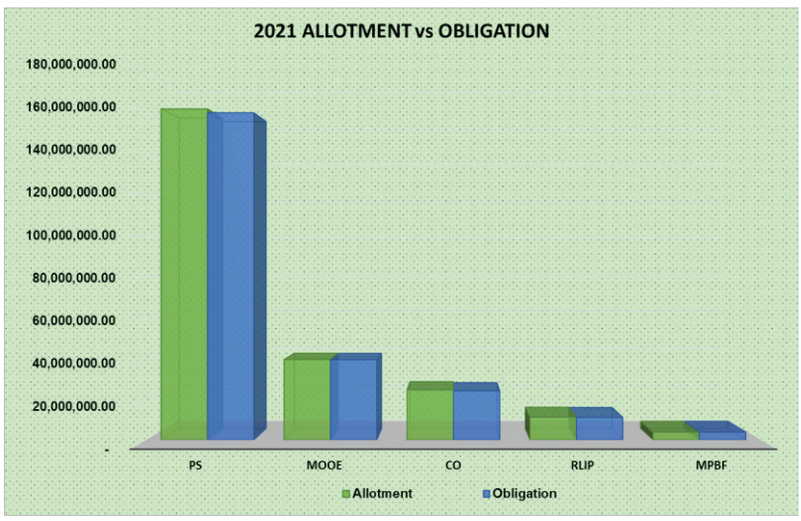
Considering all other allotments, the Center has an overall operational budget of ₱ 241,948,698.29. Out of this amount, ₱ 313,795.00 from the prior year's allotment was offered as savings. This was done in compliance with the Administrative Order (AO) No. 41, series of 2021, an order from Malacañang directing all agencies under the Executive Branch to identify savings from their respective appropriations under the General Appropriations Act (GAA) for FY2020. A negative Sub-Allotment Release Order (SARO) No. SARO-BMB-F-0006512 was received covering the withdrawal of allotment by DBM.

Out of the new Appropriations, 67.18% or ₱ 162,531,872.18 was allotted for Personnel Services (PS), 16.30% or ₱ 39,427,127.82 for Maintenance and Other Operating Expenses (MOOE), 10.15% or ₱ 24,565,000.00 for Capital Outlay (CO), 4.60% or ₱ 11,138,000.00 for RLIP, 1.57% or ₱ 3,799,073.00 for MPBF and 0.20% for Continuing Appropriations as shown:



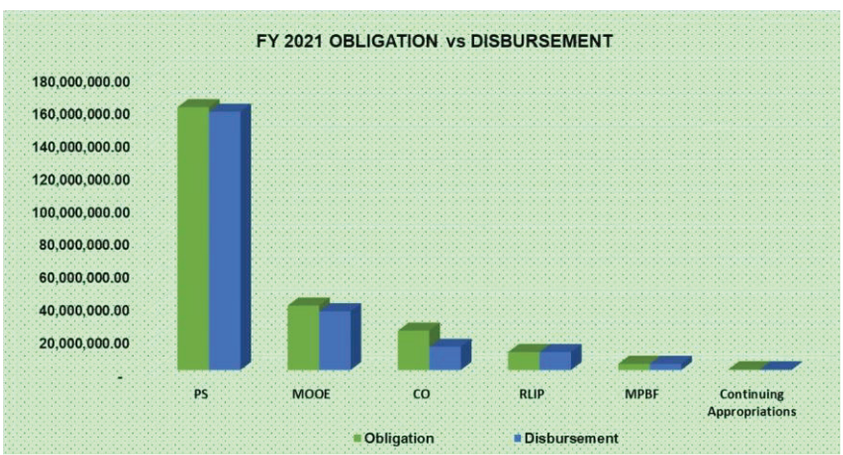
2021 Current Appropriation (Source: MIRDC-FMS Budget Unit)

Of the total allotment received, the Center obligated ₱ 239,427,914.43 or posted a 98.96% efficiency budget utilization rating for the year 2021.



2021 Current Allotment Received vs Actual Obligation (Source: MIRDC-FMS Budget Unit)

Obligation and Disbursement

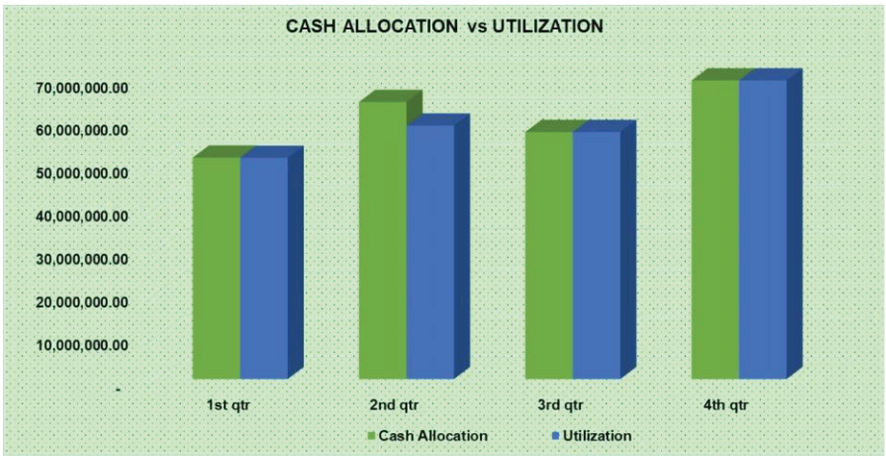


2021 Obligation vs Disbursement (Source: MIRDC-FMS Budget Unit and Accounting Unit)

Cash Allocation and Utilization

The total amount of cash released by the DBM for the year 2021 was ₱ 242,970,670.00 under the Regular MDS Account which includes regular operational requirements, payment of terminal leave benefits, and payment of Performance-Based Bonus FY 2019.

Of the total cash allotment received, ₱ 237,432,276.47 were disbursed or posted a 97.72% utilization rate.



Cash Allocation vs Utilization (Source: MIRDC-FMS Accounting Unit)

Trust Receipts: Source and Utilization

The Center received a total amount of ₱ 247,261,539.00 under its Custodial Fund from DBM. 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, and refunds of various projects.

Of this amount, the Center disbursed ₱ 142,604,533.05 or 57.67% of the total cash allocation.

The Custodial Fund provided relief and leverage in the Center's operations. It absorbed a portion of operating costs and shared in the financial burden brought about by budget reduction which started in FY2019.

Revenue Generated

MIRDC served various companies and other government offices in the field of metals and engineering industry, particularly in metal fabrication, metal analysis, calibration, and testing. The Center also administers specialized training through webinars to individuals and technical consultations and advisory services in the areas of metals and engineering, quality standards, and intellectual property.

Out of these activities, the Center was able to generate revenues from the different products and services it provided in CY 2021 despite the pandemic. These revenues were subsequently deposited to the National Treasury.

The total amount earned from various sources of revenue during the year was ₱ 21,619,909.84. Included in the reported revenue were constructive income generated out of fines and penalties imposed against the agency's suppliers.

A 15% increase in revenue was posted in FY2021. This may indicate that the Center has slowly gained recovery from operational disruption brought about by the Covid-19 pandemic.

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DOST Secretary/Ex-Officio Chairperson

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Executive Director, MIRDC

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ANTONIO A. GIMENEZ
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(Representative of Atty. Wilfred G. Moncano)
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Department of Agriculture - PhilMech

MA. CORAZON H. DICHOSA
DTI - Board of Investments

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Engineering Industry Sector

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Engr. Robert O. Dizon
Executive Director, MIRDC

Dr. Agustin M. Fudolig
Deputy Executive Director for Research and Development

Engr. Jonathan Q. Puerto
Deputy Executive Director for Technical Services

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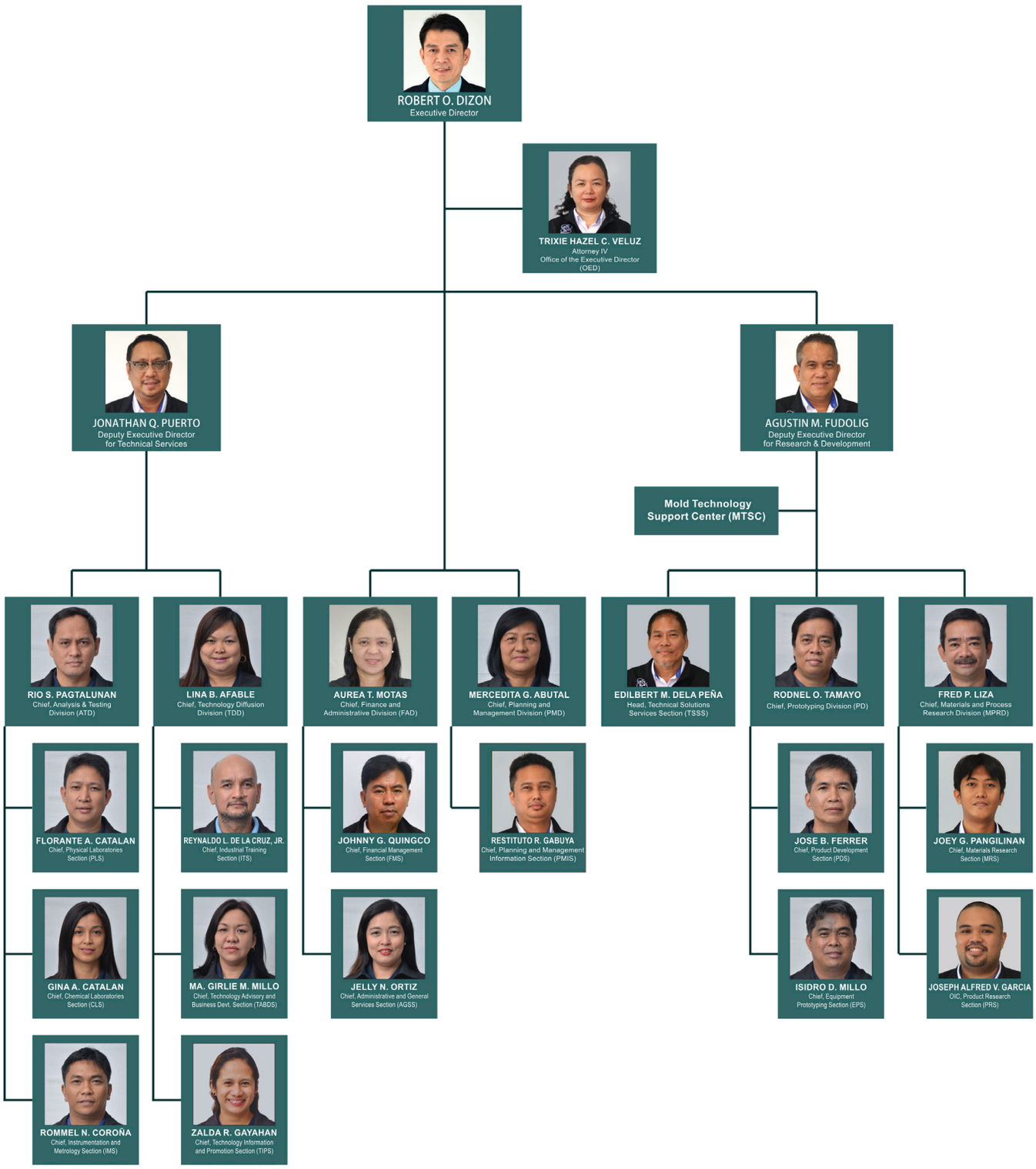
MIRDC ORGANIZATIONAL STRUCTURE

(As of December 2020)



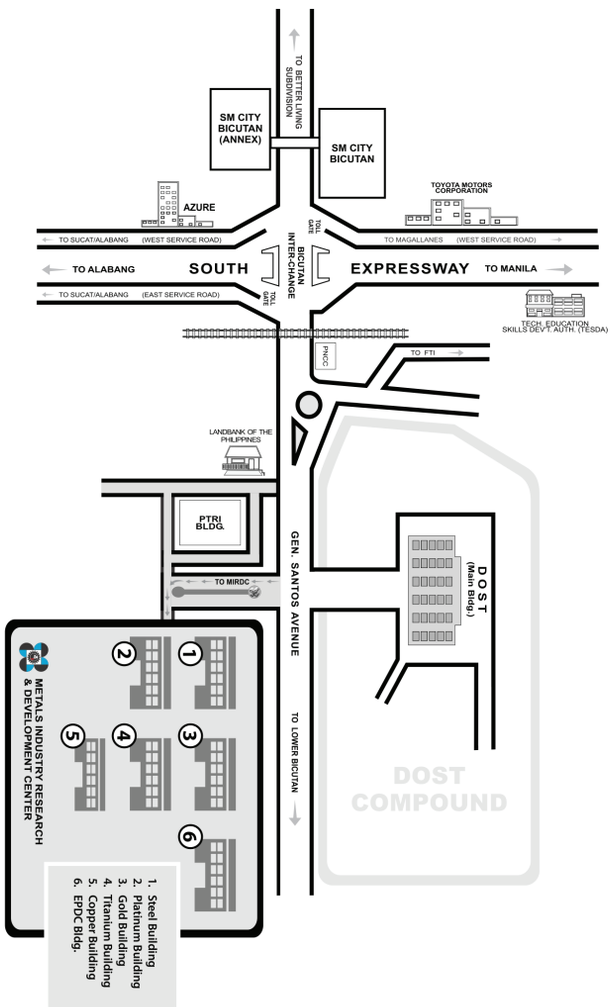
Office of the Executive Director

Research and Development Directorate

Technical Services Directorate

DOST-MIRDC LOCATION MAP

LOCATION MAP



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(088) 858-3932 (Director's Office)
(088) 858-3933 (Technical)
Contact Person: Engr. Roy C. Sagrado

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

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(From L-R)
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Not in picture: LINDA G. RIVERA, ARLENE H. ESTACIO, and IVY MARIE P. ESPINOZA

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