Metals Industry
Research and
Development Center

ANNUAL REPORT 2023

The Metals and Engineering Industry: Propelling the Economy Toward Innovativeness and Sustainability

Table of Contents

MESSAGE from the SECRETARY

My warmest congratulations to the DOST-Metals Industry Research and Development Center (DOST-MIRDC) for another year of utilizing research and development, and technological advancement to promote a better quality of life through science, technology, and innovation.

The DOST-MIRDC proactively supports the DOST's mission of making economic and social benefits from all our scientific, technological, and innovative efforts for the Filipinos. The Center's groundbreaking research, strategic partnerships, and collaborative initiatives not only push the boundaries of what is possible but also embrace our responsibility to promote sustainable practices that safeguard our planet for future generations.

This year, your research endeavors continue to push innovation and drive competitiveness and resilience within the industry. Your contributions have been instrumental in creating value for partners and stakeholders, fueling national economic growth, and fostering prosperity. The range of services provided, including R&D, technology transfer, and technical assistance, places the metals, engineering, and allied industries at the forefront of our nation's economic endeavors, facilitating job creation and technological advancement.

The DOST takes pride in the collaborations you have fostered with the private sector, the academe, and other government agencies. Through these strategic partnerships, you continue to foster a vibrant ecosystem of knowledge exchange and synergy - tackling some of the challenges facing the industry and catalyzing the development of sustainable solutions.

As we reflect on the achievements of the past year, I am confident that the men and women of DOST-MIRDC will continue to serve as ambassadors of science, technology, and innovation. Your dedication and expertise will undoubtedly continue to provide solutions and open opportunities for the metals, engineering, and allied industries.

Tunay ngang sa siyensya at teknolohiya, ang industriya ng metal ay patuloy na magpapatibay ng ating ekonomiya!

RENATO U. SOLIDUM, JR.
Secretary, DOST
and Chairperson, MIRDC Governing Council

MESSAGE from the EXECUTIVE DIRECTOR

It is with great pleasure and pride that we present the DOST-Metals Industry Research and Development Center's Annual Report for 2023, reflecting on the strides made to advance the metals, engineering, and allied industries. This report serves as a testament to our collective efforts and achievements as we remain committed to pioneering innovation and fostering sustainability for the metals industry.

The theme of this year's report, "Metals and Engineering: Propelling the Economy Toward Innovativeness and Sustainability," encapsulates the pivotal role that the metals, engineering, and allied industries play in economy building. The 2023 Annual Report puts forward DOST-MIRDC's research and development, technology transfer, and science and technology services. This report underscores how the Center's initiatives further hone the metals and engineering industries so that its products and services are instrumental in transforming various industries that depend on it to become innovative and sustainable.

As we reflect on the past year's accomplishments and gear up to face the opportunities and challenges that lie ahead, the DOST-MIRDC remains steadfast in our commitment to assisting the metals, engineering, and allied industries in its way to increased productivity and competitiveness. With the continued support and collaboration of our partners and stakeholders, we are confident that we can overcome obstacles, seize opportunities, and build a brighter, more sustainable future for all.

Our sincere gratitude to all of you, our stakeholders, partners, and colleagues, for your unwavering dedication and support. Together, let us continue to propel the economy toward new heights of innovation and sustainability.

ROBERT O. DIZON
Executive Director, MIRDC

Vision

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

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
Molding the Future of Metal Industries

2023 YEAR IN REVIEW

15 R&D projects completed (100% of target)

25 partnerships with public, private, and international stakeholders created and maintained (100% of target)

91% timeliness of projects implemented

7 technologies transferred (116% of target)

100% of requests for technology transfer delivered on time

34 technologies diffused (136% of target)

5,851 technical services rendered (136% of target)

3,466 unique clients served (182% of target)

100% of clients rated the Center's technology transfer services as satisfactory or higher

98.42% of clients rated the Center's technical services as satisfactory or higher (versus 95% of target client rating)

₱28,712,908.30 revenue generated (113% of target revenue)

2 ISO Certification/ Accreditation maintained

Research and Development

Metals and Engineering R&D for Agro-Industrial Applications

Design and Development of Conveyorized Okra Dryer

A conveyorized okra dryer was developed by the DOST-MIRDC to replace the present manual drying technique used by fresh okra exporters in the country.

The developed equipment can substantially reduce manpower in the drying operation while maintaining safety and quality standards in lieu of its food-grade stainless steel.

The prototype was fabricated in the DOST-MIRDC. It was tested, accepted, and currently adopted by the Center's R&D partner company, Jelfarm Fresh Products Enterprise. The technology is currently adopted by the partner company (Jelfarm Fresh Products Enterprise) and is expected to be transferred so that other postharvest facilities may also benefit from this technology.

Improvement in Pellet Production Efficiency of Insect Protein-enriched Animal Feed through the Investigation of Flat Pellet Mill Die Hole Parameters

The Center developed an improved design of a flat pellet mill die for the efficient pelleting of animal feed formulations that include insect-based protein.

Due to the distinct properties of insect protein, challenges in pellet production have been observed in conventional flat pellet mill dies that are designed to process plant-based ingredients such as corn and wheat.

The die fabricated by the DOST-MIRDC performed 33% more efficiently in terms of production output than the supplied die in commercial flat pellet mills.

Study on the Crankpin Fillet Fracture of Aircraft Crankshaft

This research analyzed and determined the cause of the aircraft crankshaft failure using metallurgical, mechanical, and chemical techniques. Results of the visual inspection, fractographic evaluation, and other tests conducted reveal that the crankshaft failed via fatigue mode. The fatigue crack initiated at the fillet section; a geometric discontinuity susceptible to high stress concentrations.

The findings of this study led the Civil Aviation Authority of the Philippines (CAAP) to identify possible procedural improvements. The CAAP will provide feedback to the DOST-MIRDC once improvements are finalized.

Development and Characterization of Hot-dip Aluminized Steel

The project established an alternative metal coating process on steels using a diesel-fired crucible furnace. This will benefit small companies due to low investment costs compared to typical conventional processes such as hot-dip galvanizing. The aluminum-coated steel performed better than electro-galvanized steel in terms of corrosion resistance to salt-water environment, positioning itself between stainless steel and electro-galvanizing.

For the industrial environment, the aluminized steel is comparable to stainless steel over a 10-week exposure period. A longer observation period may be necessary to obtain more conclusive data. Though the aluminized layer showed some brittleness on the bend test, it may still be acceptable provided that no subsequent forming process is performed.

Refining of Laterite-Based Crude Pig Iron for Specific Product Applications

The project is primarily aimed at establishing the feasibility of conducting additional ore processing in the Philippines. Presently, ores are partially processed in the country and are then shipped abroad for complete processing.

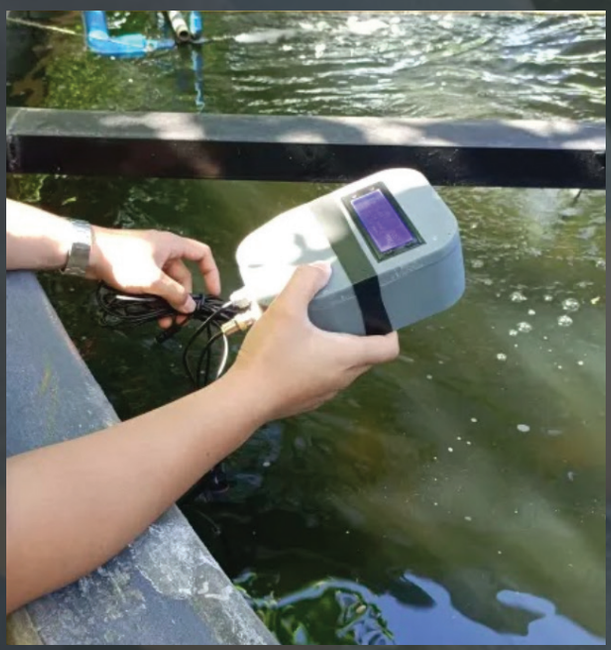
This project, was able to produce a laterite pig iron refining equipment and establish a laterite pig iron refining process. This project envisions increasing value-adding to the processing of Philippine ores and minerals in the Philippines instead of shipping them abroad to be processed. This has the potential to bring more revenue for the country and additional employment opportunities for Filipinos.

Design and Development of Retractable and Rapidly Deployable Antenna Mast

Local fabricators lack the capability to produce light, retractable, and easily deployable pneumatic masts, leading to the predominant use of cut-and-welded, non-retractable antennas in the country.

Unique features, including a rubber-sealed cap with a locking mechanism and innovative methods for retracting and extending the mast, set this project apart, suggesting potential for patent application. Notably, the project's structural integrity is assured for 10 years, and its applicability extends beyond antennas to disaster preparedness and climate monitoring.

Industry 4.0 Technologies for Agro-Industrial Applications



Development of a Multiparameter Water Quality Sensor Instrument Using Regression Values from Temperature and Acidity Measurements

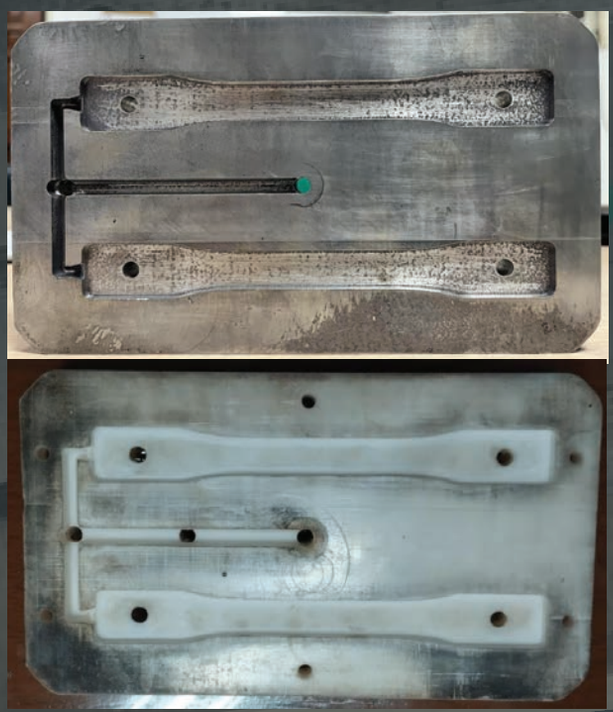
The DOST-MIRDC developed a low-cost prototype sensor system that measures ammonia and dissolved oxygen levels in closed water systems such as fish ponds or tanks. The performance of the prototype multiparameter tester developed by MIRDC in measuring dissolved oxygen is comparable with that of a standard handheld dissolved oxygen sensor when tested in commercial aquaculture ponds.

The technology will support local aquaculture operations by providing an alternative to reliably obtain multiparameter water quality data in a cost-effective manner.

An Experimental Study on the Applicability of an Air-Lift Pump to a Recirculating Aquaculture System (RAS) as an Alternative to a Submersible Pump

The study sought to identify an efficient alternative to the submersible pump that is characterized by lower energy consumption, reduced maintenance requirements, a secure and dependable pumping mechanism, and an improved oxygen concentration in the RAS water. Notably, the proposed air-lift pumping system will utilize a common air compressor instead of a water pump to improve accessibility.

With the infusion of air into the system, the air-lift pumping setup provides oxygenation and aeration that is particularly well-suited for RAS applications, especially those necessitating continuous 24-hour aeration.



Comparative Study of Different 3D Printed Injection Mold Inserts for Low-Volume Production

The project aimed to determine the mechanical performance and viability of a 3D-printed mold insert as an alternative to conventionally manufactured metal mold inserts for low-volume production using the injection molding process.

Two variants of mold inserts were produced through the project: one using rigid 10k resin, another using AlSi10Mg. These were able to withstand 250 shots with the metal mold insert with minimal signs of wear.

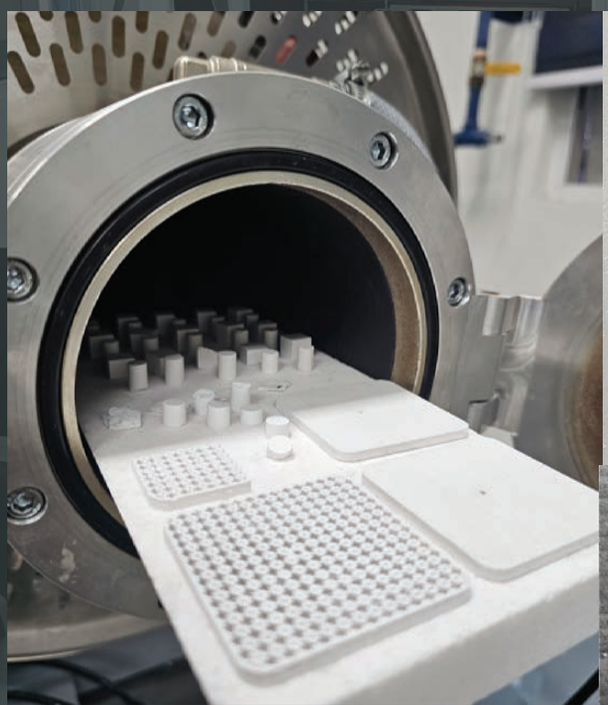
The use of 3D-printed mold inserts can potentially make low-volume plastic production more economically viable. This may also open doors for collaboration between MSMEs and mass production companies such as Manly Plastics. Using 3D-printed mold inserts, capital costs for the molds of plastic products may be reduced.

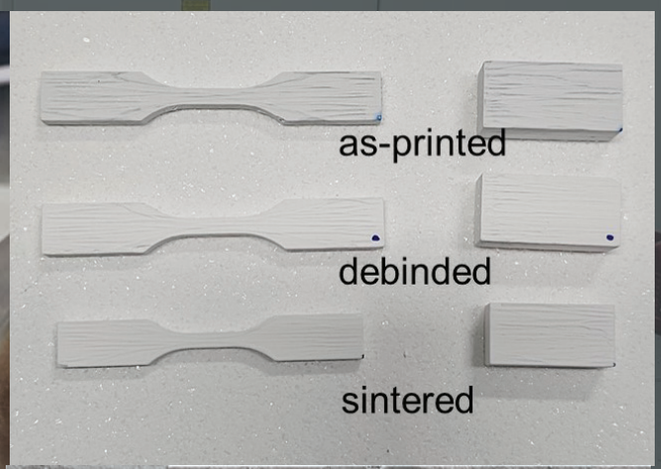
Electropolishing Optimization for Additively Manufactured Aluminum Alloy

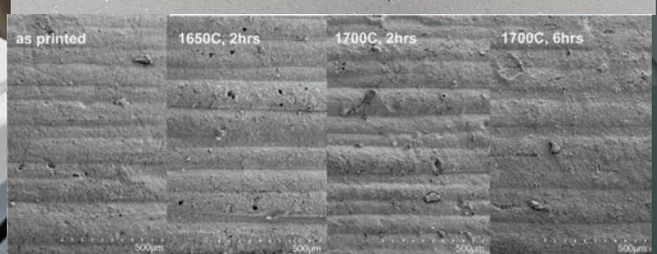
The project demonstrated that electropolishing is an effective surface treatment for resistance to corrosion and reduction of surface roughness in additively manufactured aluminum but has a contrasting result on cast aluminum samples. The project determined that the surface roughness in additively manufactured samples is significantly reduced by 62.40% according to profilometer readings and up to 34.13% according to AFM results.

This project developed an electropolishing process for additively manufactured aluminum alloy and compared the results to cast aluminum. It was observed that the concentration of solution, current density, temperature, and electropolishing time are the main process factors that determined the optimum electropolishing parameters.

This process is seen to reduce the machining of parts with complex geometries.





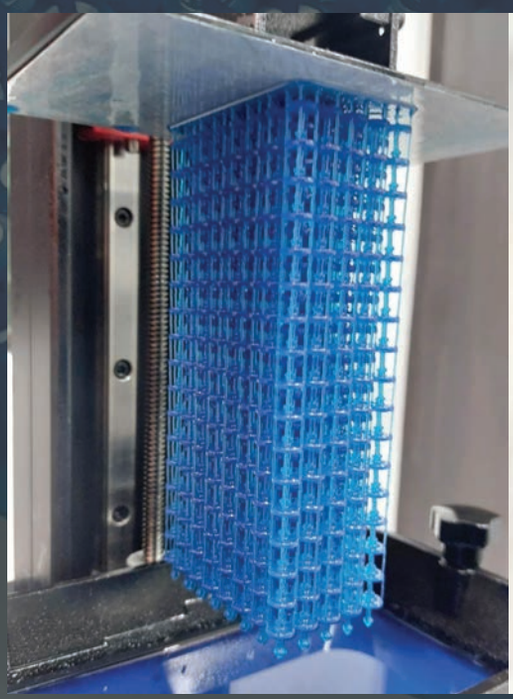


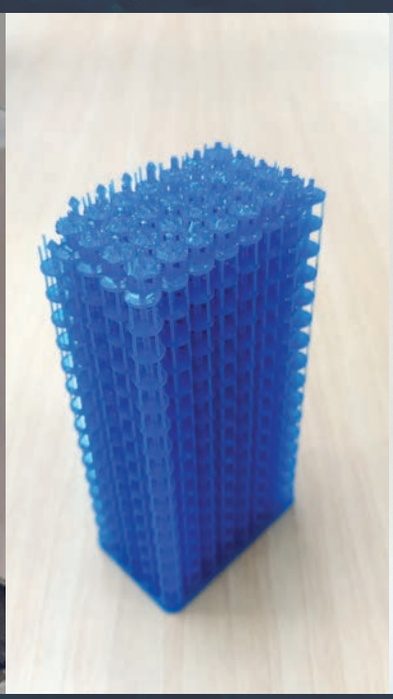
Effect of Sintering Parameters to the Physical and Mechanical Properties of Alumina Printed via Stereolithography

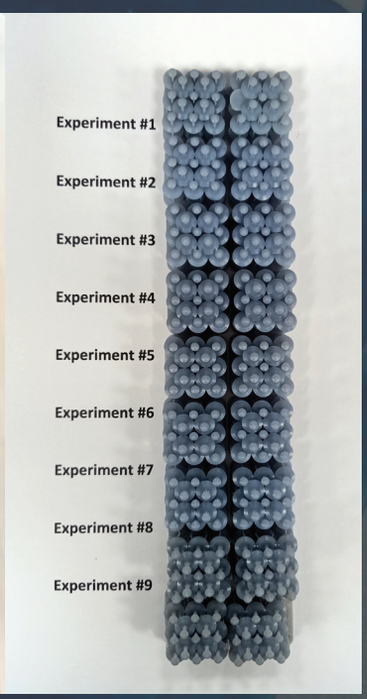
The project investigated the effect of sintering parameters, specifically time and temperature, on the mechanical and physical properties of alumina which is produced through 3D printing. The ultimate goal is to gain control over alumina properties for engineering applications by leveraging additive manufacturing and optimizing the sintering process.

The 3D printing of technical grade alumina has the potential to benefit a wide range of industries and end-users. Robust and tailor-made advanced alumina ceramics with tailored properties can find applications in cutting-edge technologies like high-performance electronic components, wear-resistant components in machining and cutting tools, thermal insulators for spacecraft, and sensor components, among others.

The investigation of the influence of sintering parameters in additively manufactured technical grade alumina holds great promise for transforming the design and fabrication of ceramics for engineering applications. As industries increasingly demand materials with superior mechanical and thermal properties, the ability to precisely control the mechanical and physical properties of ceramics through 3D printing and optimized sintering becomes a game-changer.







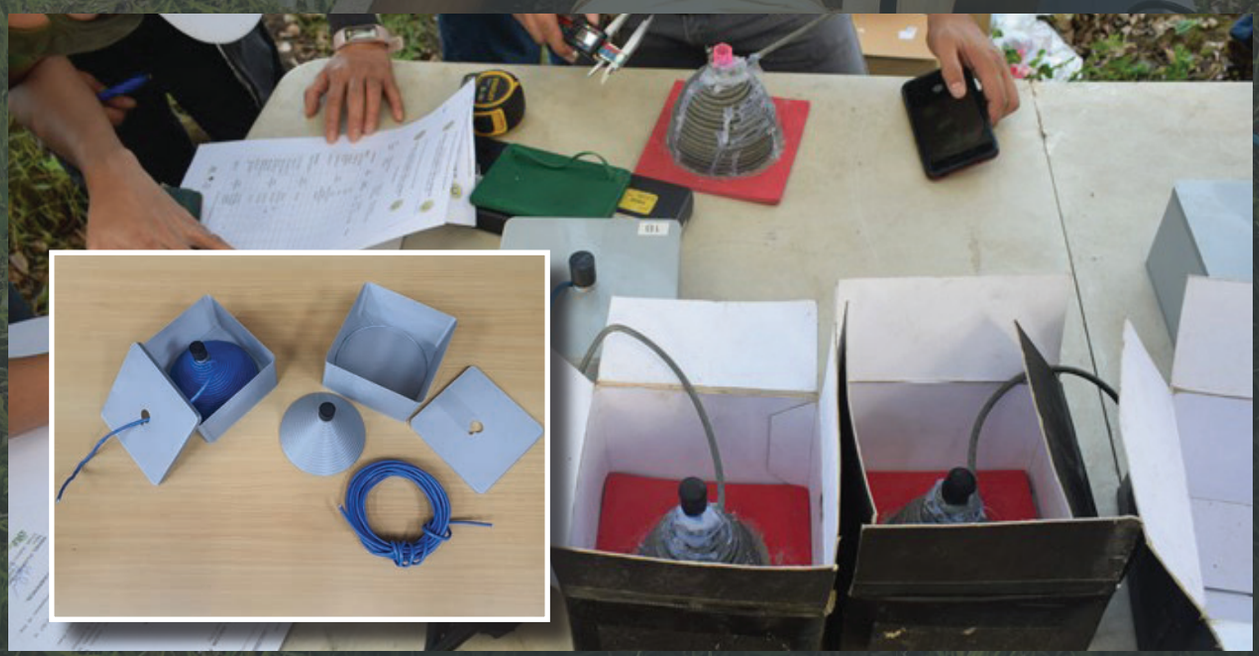
Study on the Viability of Nested, Additively Manufactured Radiation Dosimeter Security Locks

The project significantly reduced the cost of production of dosimeter locks from Php 7.00 to Php 0.50 with the use of various optimization techniques. Through this R&D project, the Philippine Nuclear Research Institute (PNRI) became fully in control of the production process and did not rely on suppliers such as an injection mold company.

This project proved that 3D-printed dosimeter locks are more streamlined and cost-effective than those produced through plastic injection mold. With the use of additive manufacturing in the production of the dosimeter locks, manufacturing time and tooling costs are reduced.

The technique used in this project can be adopted by others engaged in the production of small-scale products.

Metals and Engineering R&D for National Defense



Design Improvement and Fabrication of 3D Printed Improvised Explosive Device (IED) Disruptor

The project developed an improved standardized 3D printed IED disruptor assembly through additive manufacturing (AM) that can be used in the bomb disposal operations of the Explosive Ordnance Division (EOD) of the Philippine Army (PA).

Standardization of the design of IED disruptors for the PA's EOD battalion is to significantly enhance effectiveness and user-friendliness, ultimately ensuring the safety of soldiers in the field. By producing 3D printed IED disruptors, the annual demand of the PA's EOD battalion as part of the broader PA Modernization Program can be met.

The standardization of disruptor design and the utilization of 3D printing technology proves valuable to the PA, specifically its Army Support Command (ASCOM) and Research and Development Center (RDC). The DOST-MIRDC's Advanced Manufacturing Center (AMCen) assisted in enhancing RDC, ASCOM, and PA personnel's ability to design 3D objects, operate 3D printers, and independently manufacture IED disruptor components through training sessions. This partnership is a step toward PA's adoption of AM and the establishment of its own AM facility.

Metals and Engineering R&D for Mass Transportation Solutions

Design and Development of an Automated Disinfection Fogging System for a HET

The Center developed a commercially accessible fogging system to disinfect train coaches to address the inefficiencies associated with manual cleaning and disinfection. This disinfection fogging system is developed for the DOST-MIRDC's HET.

Aside from assessing the effectiveness and feasibility of utilizing a commercial fogging machine to disinfect the coaches of the HET, the project also determined the optimal fogging duration and disinfectant consumption for sanitizing the passenger coaches of the HET and compared the disinfection cost of the proposed fogging system with the current manual method employed for train coach disinfection. The automated fogging system performance is significantly better than manual operations in terms of operating costs and disinfection time.

Special thanks to DOST-MIRDC's R&D Partners:

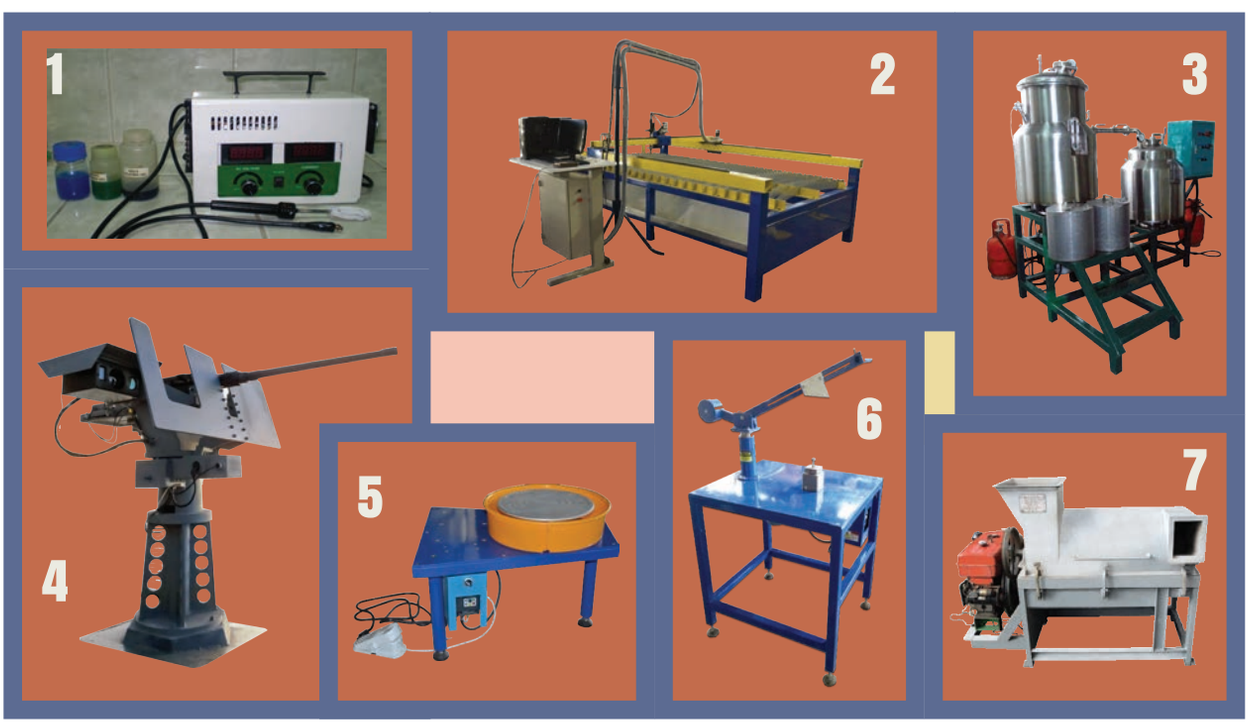
- *Jelfarm Fresh Products Enterprise*
- *DOST-Advanced Science and Technology Institute (DOST-ASTI)*
- *Philippine National Railways*
- *FAST Aviation Academy, Inc.*
- *Mines and Geosciences Bureau*
- *DOST-Philippine Nuclear Research Institute (DOST-PNRI)*
- *Manly Plastics Inc.*
- *Research and Development Center, Army Support Command, Philippine Army*

Technology Transfer

Technologies Transferred/Technology Adopters

7 technologies developed by the Center were adopted by 6 licensees.

Name of Technology	Region	Technology Adopter
1. Non-Cyanide Gold Electroplating	NCR (Manila)	Bangko Sentral ng Pilipinas
2. CNC Plasma	Region IVA (Silang, Cavite)	ERML Trading & Engineering
3. Vacuum Fryer	Region I (Pangasinan)	DM Baylon Manufacturing and Industrial, Inc.
4. BUHAWI Remote-Controlled Weapons System (RCWS)	NCR (Quezon City)	Gecar Machine Solutions, Inc.
5. Electric Potter's Wheel (EPW)	NCR (Parañaque)	Microcontrol Design Technology, Inc.
6. Jigger and Jolly Machine (J&J)		
7. Decorticating Machine	Region IX (Zamboanga del Sur)	Agricom Zamboanga, Inc.



Tech Transfer Updates on Locally Developed Transportation Technologies

DOST-MIRDC and PNR Collaborate for Maintenance and Troubleshooting Activities for the Hybrid Electric Train (HET)

The DOST-MIRDC collaborated with the Philippine National Railways (PNR) technical personnel in conducting maintenance and troubleshooting activities for the HET, supplying consumable items necessary for its upkeep, and extending a warranty covering the repair or replacement of faulty components.

Additionally, the project conducted a ridership study to calculate the revenue stream, assessed the operational cost of the HET functioning as a revenue train, and optimized both the load-sharing mechanism and overall performance through various optimization activities. Furthermore, the project optimized a control system wherein speed control of the HET may be enabled using a VFD through a dedicated network or external terminal.

North Cotabato Adopts DOST-MIRDC's Hybrid Electric Road Train (HERT)

To materialize Region XII's commitment to sustainable transportation and environmental conservation, a Memorandum of Agreement (MOA) was forged for the adoption of the DOST's Hybrid Electric Road Train (HERT) on July 3, 2023 at Kidapawan City, North Cotabato.

The adoption of the DOST HERT in North Cotabato marks a significant stride towards a greener and more sustainable future. By incorporating the HERT into its transportation framework, the province showcases its determination to reduce harmful environmental impacts while enhancing the quality of life for its citizens.

L to R: DOST XII Regional Director Sammy P. Malawan, Cotabato Vice Governor-elect Efren F. Piñol, DOST Undersecretary Sancho A. Mabborang, Cotabato Governor Emmylou J. Taliño-Mendoza, and DOST-MIRDC Deputy Director for Technical Services Jonathan Q. Puerto

Sales Up for MIRDC Licensee

Gecar Machine Solutions, Inc. is one of the Center's trusted partners as it is a licensed fabricator of various DOST-MIRDC-designed and developed food processing equipment (FPE) such as the vacuum fryer, water retort, and spray dryer. In 2023, the company fabricated a total of six FPEs which were delivered to DOST IV-A, Philippine Women's College, Natpril, Morong, Visayas State University, and Davao Del Norte State College.

With the FPEs added to the company's portfolio of technologies, Gecar Machine Solutions generated a significant increase in its sales.

Water Retort and Vacuum Fryer fabricated by Gecar Machine Solutions, Inc.

34 Technologies diffused (136% of target)

38 Promotional events conducted

2,118 Attendees to promotional events

100% of attendees rated the Center's promotional events as very satisfactory or higher

2023 Major Events

2023 Metals and Engineering Week (M&E) Celebration

This event is held every 3rd week of June; for this year's M&E Week celebration, the DOST-MIRDC held its M&E Industry Forum, conducted various free webinars, an Open House tour of its facilities, and the M&E Skills Competition and Awarding.

2nd National M&E Conference

The 2nd National M&E Conference was held during the 2023 M&E Week celebration at the Acacia Hotel Manila, Alabang. The conference saw the presentation of 29 technical papers related to M&E. Twenty-nine were published in the DOST-MIRDC's Philippine Metals 2023.

2023 Regional Science and Technology Week (RSTW) Celebrations

The DOST-MIRDC showcased its technologies and services to 11 regions during their respective RSTW celebrations. The Center featured the Advanced Manufacturing Center, Metals and Engineering Innovation Center, Mold Technology Support Center, Advanced Mechatronics, Robotics, and Industrial Automation Laboratory, and food processing technologies, among others.

TeknoMETALino Forums

The Center held its TeknoMETALino Forums at the RSTW celebrations around the country and during the 2023 NSTW celebration in Iloilo City. The forums featured technologies and facilities such as the AMCen, MEIC, MTSC, AMERIAL, food processing technologies, and alternative mass transportation solutions.

2023 National Science and Technology Week

The DOST-MIRDC was part of the "Job Creation" exhibit during the 2023 NSTW celebration on November 22 to 29, 2023 at the Iloilo Convention Center. The Center showcased AMCen's 3D printing technologies, services, and products, contributing to the central theme "Siyensya, Teknolohiya, at Inobasyon: Kabalikat sa Matatag, Maginhawa, at Panatag na Kinabukasan."

AMCen CONNECT3DMINDS: PartnerShape Day

The DOST-MIRDC, through AMCen, held the PartnerShape Day which fosters innovation and celebrates its accomplishments through collaboration among the government, the industry, and the academe. The event also solidified future collaborations among AMCen's old and new partners.

Advanced Welding Training Center (AWTC) launch

Held in October 2023, the launch of the AWTC is seen to address the country's need for more training offerings on advanced welding processes. This facility is poised to amplify the welding proficiency of the local workforce to cater to the increasing demands for skilled welders both in the country and abroad.

425

IEC Materials Produced

Including the DOST-MIRDC 2023 industry study entitled "Exploring Growth Opportunities for the Shipbuilding and Ship Repair Industry in the Philippines"

9 Industry Dialogues and **2** Focus Group Discussions were conducted

Technologies for Commercialization

1. Building a Universal Mount for Heavy-Barrel Automated Weapon Integration (BUHAWI)
2. Hybrid Electric Road Train
3. Hybrid Electric Train
4. Automated Guideway Transit
5. Automatic Trash Rake
6. Integrated Wrought Iron Forming Equipment (iWIFE)
7. Water Hyacinth Harvester
8. Tikog Flattening Machine
9. Pandanus Leaves Slitter-Presser
10. Abaca Fiber Stripping Machine
11. Rice Harvester Attachment
12. Rice Transplanter Attachment
13. Compact Rice Mill Chute
14. Superheated Steam Treatment System for Stabilized Brown Rice Production
15. Water Retort
16. Spray Dryer
17. Freeze Dryer
18. Vacuum Fryer
19. Electric Potter's Wheel
20. Jigger and Jolly Machine

Science and Technology Services

Technical Services Highlights

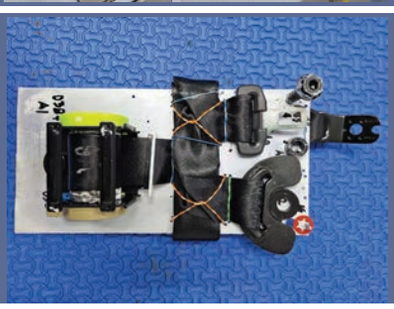
The DOST-MIRDC's analysis and testing services were tapped by:

1. the Department of Agriculture for the chemical analysis of samples of shredder blades used in Composting Facilities for Biodegradable Wastes (CFBW), facilities which convert biodegradable wastes into compost, which is then distributed to various drop-off points in Visayas and Mindanao
2. the Build, Build, Build Program initiated by the Duterte administration for the chemical analysis of bolts, nuts, and washers to be used in the Metro Manila Subway project
3. the Department of Trade and Industry - Bureau of Product Standards (DTI-BOI) for the conduct of a 50-hour salt spray test of automotive safety belt products as a requirement of PNS-1892.

1

2

3



Support to the Comprehensive Automotive Resurgence Strategy (CARS) Program

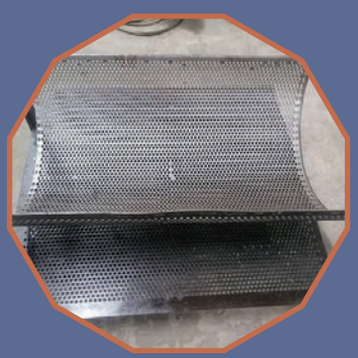
The DOST-MIRDC conducted an assessment audit of Toyota Motors Phils. Corp. and Mitsubishi Motors Phils. Corp. and their outsourced suppliers. The Center evaluated the acceptability, quality, and qualification of capital investments undertaken by these car makers under the CARS program, and determined which investments are qualified for Fixed Investment Support subsidies, a program under the Department of Trade and Industry's Bureau of Internal Revenue.

PCB Overmold Assembly for Orthopaedic International Inc. (OII)

MIRDC provided support to OII by producing a mold to be used on a table-top injection machine. The injection machine is used for coating a sensor with plastic to protect its electrical components. A simple mold structure was proposed by MIRDC to save cost. Two dowel pins were also added to ensure alignment of the mold plates.

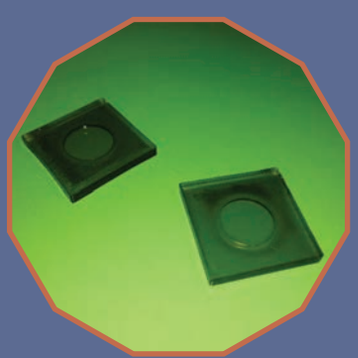
Localization of a Cylindrical Sieve for Plastic Production

MIRDC was able to produce locally a cylindrical sieve used in plastic production. M-Plus Plastics Manufacturing Corporation used to import this component. This is another proof that there are many imported components used in the industry that can be produced locally.



PETValue Philippines

PETValue Philippines, set to be the country's first bottle-to-bottle, food-grade recycling facility, is producing recycled plastics for PET bottles of Coca-Cola. PETValue is conducting quality assurance testing procedures on their recycled plastics. Their testing procedure requires a certain shape and thickness of the test samples. MIRDC produced a mold for PETValue to shape their test samples. MIRDC also provided plastic injection services to PETValue where recycled plastics were fed into the plastic injection machine producing the test samples that PETValue needed.



Consultancy Services Focused on Addressing Additive Manufacturing Requirements

The DOST-MIRDC, through the AMCen facility, conducted consultancy services through the sharing of technical expertise. In research and development, the AMCen team shared insight and guidance on using additive manufacturing to innovate or improve the clients' new/ existing products and processes. The adoption of AM technologies in research may have a significant difference in the quality and impact of the product due to the advanced capabilities of the technology and its practical application.

Materials Research-Related Consultancy Services

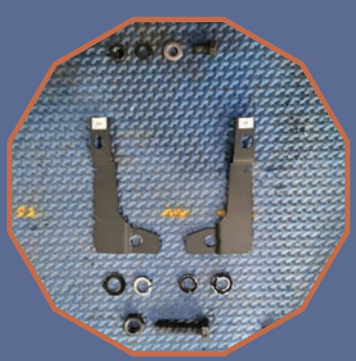
The Center engaged in consultancies to various industries mostly focusing on identifying possible R&D with local foundries and exploiting the Center's capabilities on failure analysis, material characterization tests, and material identification and selection.

BOI-JICA Training

An effort to augment the small number of experts in die technology in the Philippines, MIRDC personnel underwent a series of training on tool and die under Japan International Cooperation Agency (JICA). The training is a preparation for the personnel to become consultants in die technology. A culminating event was held on December 4, 2023, attended by stakeholders such as Metalworking Industries Assn. of the Philippines (MIAP) and Philippine Die and Mold Association (PDMA). Reporting of activities during the year and exploring future endeavors were the main agenda

Design and Production of Punch and Die for Machine Gun Support Brackets

As a response to the need to produce more support brackets for the Philippine Army, MIRDC developed a punch and die set to hasten production. The brackets are developed due to slight deformation of machine gun barrel after firing. The deformation makes it more difficult for the user to fix target as adjustment is required when the barrel bends downward. One hundred sets of brackets were produced and distributed to different parts of the Philippines for field testing including in Mindanao.

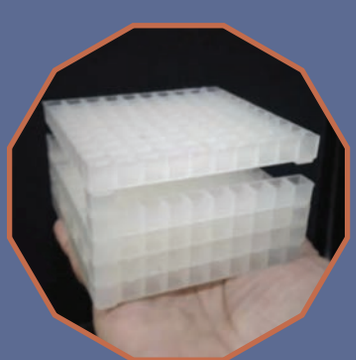


Support to Students

Several students requested fabrication services from MIRDC to complete their research, thesis, and other school requirements. The Center was able to share expertise in welding, fabrication, and machining processes with students from Technological University of the Philippines, De La Salle University-Manila, Mapua Malayan Colleges Laguna, San Jose Del Monte Science High School, Rizal Technological University, San Miguel National High School, and Adamson University.

Support to South Hill School, Inc.

Students from South Hill School, Inc. sought help from MIRDC in their project “Converting Single-Use Plastic Wastes into Base Ten Blocks for Mathematics.” Base ten blocks are used in elementary schools as a learning aid for counting numbers. MIRDC provided help by designing and machining the mold needed to produce the blocks. A series of consultations was conducted to complete the mold design considering the financial and time resources of the students.



Seminars/Workshops/Skills Training Programs

In pursuit of the Center's mission of providing professional management and technical expertise to the metals, engineering, and allied industries, the Center:

- conducted 206 training programs. These include non-destructive testing, application of CAD/CAM, heat treatment of steels, basics on additive manufacturing, non-cyanide gold plating, machine shop operation, advanced technical drawing, and 5S in action.
- designed 2 new training programs and 3 online modules

2,222

Clients served by the training programs

6,679

Industry personnel trained

Technical Services Accomplished by the DOST-MIRDC's AMCen and MTSC

81 consultancy services for various industries focused on the use of additive manufacturing to develop new products and improve existing ones.

81

Consultancies conducted





AMCen
Advanced Manufacturing Center
Beyond the Conventional.

3,626

Total industry personnel trained

3,626 total industry personnel trained. These training programs enhanced the participants' skills in die and mold.

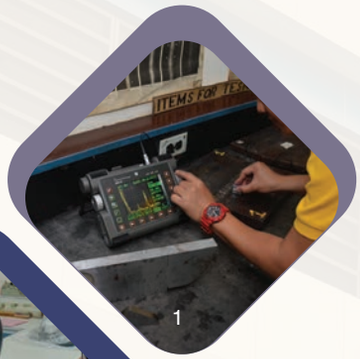




MTSC
MOLD TECHNOLOGY SUPPORT CENTER

Facilities of the DOST-MIRDC

1. Non-Destructive Testing
2. Calibration and Metrology Laboratory
3. Physico-Chemical Laboratory
4. Mechanical Laboratory
5. Auto-Parts Testing Laboratory
6. Physical Metallurgy Laboratory
7. Surface Engineering Facility
8. Metal Casting Facility
9. Die and Mold Solution Center / Gear Making Facility
10. Advanced Mechatronics, Robotics, and Industrial Automation Laboratory
11. Advanced Manufacturing Center (AMCen)
12. Advanced Welding Training Center
13. Sheet Metal Fabrication Facility
14. Mold Technology Support Center
15. Metals and Engineering Innovation Center



Metals and Engineering Innovation Center

Region I
MEIC-DMMSU

R&D Engagement: 6 projects
% Accomplishment of all R&D Projects: 88%
IPs Filed: 4
OneExpert: 6 personnel enrolled in OneExpert with the following specializations: Machine Innovation, Design and Fabrication, Welding Process-SMAW, Electrical Engineering, Power Systems, and CAD Operation.

Cordillera Administrative Region
MEIC-IFSU

R&D Engagement: 4 projects
% Accomplishment of all R&D Projects: 93%
IPs Filed: 4
OneExpert: 1 personnel enrolled in OneExpert with a specialization in Engineering Fabrication.

Region II
MEIC-CSU

RR&D Engagement: 6 projects
% Accomplishment of all R&D Projects: 77%
IPs Filed: N/A
OneExpert: 1 personnel enrolled in OneExpert with a specialization in Agricultural and Biosystems Engineering.

Region III
MEIC-NEUST

R&D Engagement: 6 projects
% Accomplishment of all R&D Projects: 97%
IPs Filed: 4
OneExpert: N/A

Region X
MEIC-USTP

R&D Engagement: 6 projects
% Accomplishment of all R&D Projects: 76%
IPs Filed: N/A
OneExpert: 1 personnel enrolled in OneExpert with a specialization in Machinery Design or Industrial Processes.

Balik Scientist at the DOST-MIRDC

The Center consistently shows strong support to the programs of the DOST, including the Balik Scientist Program (BSP) whose goal is to encourage Filipino scientists and technologists based abroad to return to the Philippines and share their expertise to develop the country.

In 2023, the DOST-MIRDC hosted Dr. Eugene B. Caldona from July 1 to 21, 2023.

Dr. Caldona is an Assistant Professor in the Department of Coatings and Polymeric Materials at North Dakota State University (NDSU) - one of the premier coatings institutions in the world. His expertise is in coatings, and his areas of interest are in polymers and additive manufacturing.

As DOST-MIRDC's Balik Scientist, Dr. Caldona imparted his knowledge and skills through the following activities:

- Rendered advisory work on the conceptualization, proposal writing, and implementation of projects aligned to the Surface Engineering R&D program.
- Conducted lectures on literature and paper reviews.
- Reviewed, evaluated, and provided inputs on scientific and technical papers generated by MRS researchers.
- Reviewed, provided inputs, and helped in identifying specific interventions and projects to be included in the Surface Engineering R&D program.
- Provided recommendations/list of best practices and equipment of R&D and services institutions abroad.
- Conducted hybrid seminars on the following topics:
  - Writing and publishing a scientific paper
  - Surface electrochemical approaches to evaluating corrosion-preventing materials
  - Conventional and modern approaches to characterizing polymeric materials
  - Additive manufacturing of engineering and high-performance polymeric materials
  - High performance thermosets, semi-fluorinated polymers, thin films, composite coatings, and 3D printed materials.

More Key ACCOMPLISHMENTS

8

Intellectual property rights granted

1. System of Assembling a Combined Harvester and Thresher Attachment to Hand Tractor and the Apparatus	Utility Model
2. Firing Mechanism for Caliber 0.50 Heavy Barrel of an Industrial Machine Gun	Industrial Design
3. Charging Mechanism for Caliber 0.50 Heavy Barrel Machine Gun	Industrial Design
4. Recoil Compensator Caliber 0.50 Heavy Barrel Machine Gun	Industrial Design
5. BUHAWI Back End Program	Copyright
6. PLC Program of BUHAWI System	Copyright
7. Automated Gun Mount	Industrial Design
8. Neonatal Nasal Mask	Industrial Design

22

Intellectual property rights filed

41

plant tours conducted

10

peer-reviewed papers published

10

peer-reviewed papers presented at conferences

13

non-peer-reviewed papers published

7

non-peer-reviewed papers presented at conferences

Awards and Recognitions Received

Division Model Employee - Level I

Mary Joy M. Bautista
Laboratory Inspector II
Analysis and Testing Division

Arnel T. Tuvillo
Administrative Aide VI
Finance and Administrative Division

Jayson S. Candil
Metal Technologist II
Prototyping Division

Gil R. Roa
Administrative Assistant III
Planning and Management Division

Ronald L. Agustin
Senior Administrative Assistant II
Technology Diffusion Division

Jose D. Berces III
Production Cost Estimator II
Technical Solution Services Section

Division Model Employee - Level II

Morris D. Pioquinto
Science Research Specialist II
Analysis and Testing Division

Rosario D. Sancon
Administrative Officer V
Finance and Administrative Division

Nicole Ann Portia U. De Luna
Science Research Specialist II
Prototyping Division

Francis Albert M. Ferrer
Information Systems Analyst I
Planning and Management Division

Linda G. Rivera
Senior Science Specialist
Technology Diffusion Division

Vincent Boy E. Manabat
Science Research Specialist II
Technical Solution Services Section

MIRDC Model Employee

Level I
Arnel T. Tuvillo
Administrative Aide VI
Finance and Administrative Division

Level II
Morris D. Pioquinto
Science Research Specialist II
Analysis and Testing Division

MIRDC Best Section Award

Instrumentation and Metrology Section (IMS)
Analysis and Testing Division

Cost Economy Measure Award

Equipment Prototyping Section (EPS)
Prototyping Division

Core Value Award

Professionalism
Ronie S. Alamon
Science Research Specialist II
Prototyping Division

Responsiveness
Lemuel N. Apusaga
Senior Science Research Specialist
Materials and Process Research Division

Integrity
Franz Joseph D. Libao
Senior Science Research Specialist
Prototyping Division

Dynamism
Rey N. Mariposque
Senior Science Research Specialist
Technology Diffusion Division

Excellence
Agnes F. Pedraza
Administrative Officer V
Finance and Administrative Division

Performance Excellence Award

Marvin M. Musnit
Metals Technologist III
Mold Technology Support Center

Arn James M. Vengua
Senior Science Research Specialist
Mold Technology Support Center

Alma C. Dupagan
Training Specialist II
Technology Diffusion Division

Claudine R. Sinag
Training Specialist I
Technology Diffusion Division

Al Lois G. Tuesca
Draftsman II
Technical Solution Services Section

Andrew Mike Alfaro
Metal Technologist III
Technical Solution Services Section

Ely C. Delos Reyes
Metal Technologist V
Technical Solution Services Section

Virgilio Y. Macanip Jr.
Administrative Assistant III
Technical Solution Services Section

Ramon M. Martin
Metal Technologist V
Technical Solution Services Section

Augusto S. Atanacio Jr.
Metal Technologist V
Technical Solution Services Section

Eleno F. Dalida
Metal Technologist III
Technical Solution Services Section

Bobby F. Fronda
Metal Technologist IV
Technical Solution Services Section

Simplicio N. Morla Jr.
Metal Technologist IV
Technical Solution Services Section

Jan Michael E. Saludes
Metal Technologist IV
Technical Solution Services Section

Academic Awards (Graduate)

Mervin B. Gorospe
Senior Science Research Specialist
Technology Diffusion Division
Master of Technology Management

Best FOI Receiving Officer

Abigail M. Casas
Administrative Officer I
Finance and Administrative Division

2023 DOST Intellectual Property Awards - International Publication Award

Title: Alignment control using visual serving and mobile net single-shot multi-box detection (SSD): A review.	**Jayson P. Rogelio**	*Prototyping Division*
Title: Rice Bran Drying Kinetics of a Controlled Microwave Vacuum Dryer Optimized PLC-based: A Neuro-fuzzy Approach.		

2023 DOST Intellectual Property Awards - Industrial Design

• *Hand Tractor-Attached Rice Transplanter*	**Isidro D. Millo**	*Prototyping Division*
• *Pottery Wheel*	**Emerito V. Banal**	*Prototyping Division*
• *Clay Jiggering and Jollying Machine*	**Raymond S. De Ocampo**	*Analysis and Testing Division*
	Ronie S. Alamon	*Prototyping Division*
	Denise Daryl A. Florante	*Materials and Process Research Division*

2023 DOST Intellectual Property Awards - Utility Model

• *A Mobile Workstation with An Expanded Platform for Collaborative Robot*	**Isidro D. Millo**	*Prototyping Division*
	Ronie S. Alamon	*Prototyping Division*
	Raymond S. De Ocampo	*Analysis and Testing Division*

2023 Regional Invention Contest and Exhibits (RICE) NCR

• *Sugarcane Stripper - 3rd Placer Utility Model Category*	**Isidro D. Millo**	*Prototyping Division*
• *Hand Tractor-Attached Rice Harvester - 3rd Placer*	**Emerito V. Banal**	*Prototyping Division*
	Raymond S. De Ocampo	*Analysis and Testing Division*
	Ronie S. Alamon	*Prototyping Division*
	Denise Daryl A. Florante	*Materials and Process Research Division*

Intellectual Property Awards - Approved Industrial Design

• *Recoil Compensator for Caliber 0.50 Heavy Barrel Machine Gun* *Registration No. 3/2022/050586*	**Jonathan Q. Puerto**	*Office of the Executive Director*
	Rodnel O. Tamayo	*Prototyping Division*
	Fred P. Liza	*Materials and Process Research Division*
• *Charging Mechanism for Caliber 0.50 Heavy Barrel Machine Gun* *Registration No. 3/2022/050588*	**Remartin S. Maglantay**	*Prototyping Division*
	Manuel O. Alberto Jr.	*Prototyping Division*
	Romanico F. Salido	*Prototyping Division*
• *Automated Gun Mount* *Registration No. 3/2022/000079*	**Vincent Boy E. Manabat**	*Technical Solution Services Section*
• *Firing Mechanism for Caliber 0.50 Heavy Barrel Machine Gun* *Registration No. 3/2022/050587*	**Anthony Aldrin V. Beltran**	*Prototyping Division*
• *Mobile Trailer Truck For Food Processing* *Registration No. 3/2022/050047*	**Ronie S. Alamon**	*Prototyping Division*
	Raymond S. De Ocampo	*Analysis and Testing Division*
• *Clay Jiggering and Jollying Machine ID* *Registry No.:3/2020/000064*	**Joein L. Luces**	*Prototyping Division*
	Jayson S. Candil	*Prototyping Division*
• *Pottery Wheel* *ID Registry No.:3/2020/000065*	**Isidro D. Millo**	*Prototyping Division*

Team Empowerment

TOWARDS ENHANCED COLLABORATION AND BETTER OUTCOMES

Here at the DOST-MIRDC, we strive to boost confidence and develop resilience among employees through strategies that will enable us to grow, learn, and be productive as well as find joy in the workplace.

During the year 2023, several technical and non-technical trainings and seminars were conducted to enhance our knowledge and skills in our respective fields. Moreover, activities such as the annual sports fest, DOST-MIRDC employees' day, year-end Thanksgiving celebration, healthy lifestyle/physical fitness program, and blood donations were also held to promote a work-life balance among our employees.

Because at MIRDC, we believe that happy employees are productive and efficient employees.

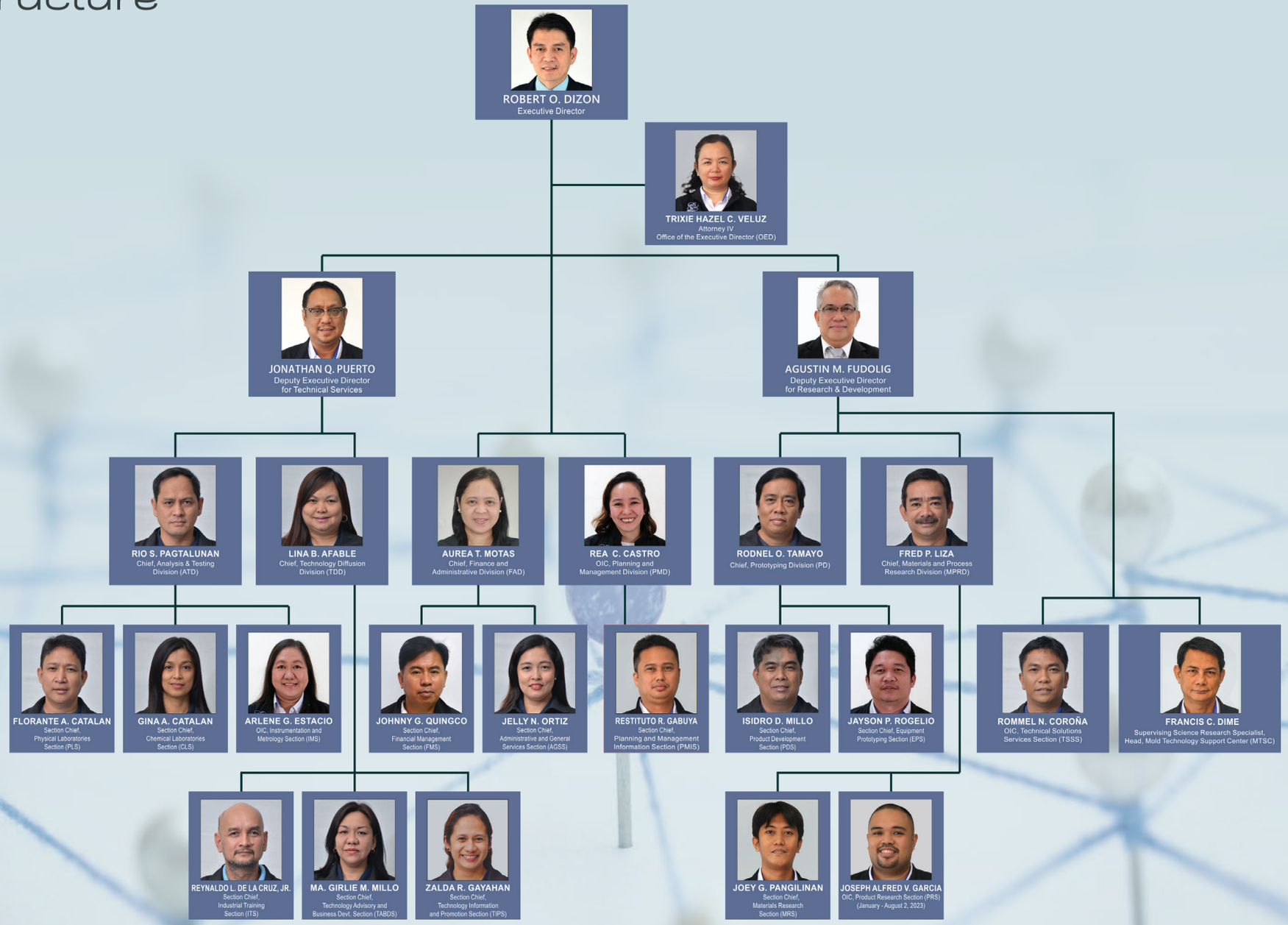
2023 Financial Statements

Utilization Rate Per Allotment Class

Allotment Class	Allotment*	Obligations Incured	BURS %
Personnel Services	179,579,643.92	179,522,230.40	99.97%
Maintenance and Other Operating Expense	30,187,356.08	30,187,356.08	100.00%
Capital Outlay	-	-	0.00%
RLIP	11,467,000.00	11,467,000.00	100.00%
LFP - MOOE	17,028,000.00	12,545,900.95	73.68%
LFP - CO	20,000,000.00	19,937,598.41	99.69%
Special Purpose Fund*	4,997,636.00	4,984,541.41	99.74%
Continuing Appropriation	354,654.56	352,227.88	99.32%
Total	**263,614,290.56**	**258,996,855.13**	**98.25%**

**change in amount of allotment due to reclassification/ realignment*

MIRDC Organizational Structure



Governing Council Members

RENATO U. SOLIDUM, JR.
DOST Secretary

ROBERT O. DIZON
Executive Director, MIRDC

JEREMY T. AGUINEA
Engineering Industry Sector

AUGUSTO C. SOLIMAN
Allied Industry Sector

JUANCHO PABLO S. CALVEZ
(Representative of Atty. Wilfred G. Moncano)
DENR - Mines and Geosciences Bureau

NEIL P. CATAJAY
DTI - Bureau of Philippine Standards

DIONISIO G. ALVINDIA
Department of Agriculture - PhilMech

MA. CORAZON H. DICHOSA
DTI - Board of Investments

BIEN A. GANAPIN
National Economic & Development Authority

ROBERTO M. COLA
Metals Industry Sector

The Top Management

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

Engr. Robert O. Dizon
Executive Director, MIRDC

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

Management Committee

Standing (L-R): Engr. Rodnel O. Tamayo, Dr. Agustin M. Fudolig (Deputy Exec. Dir. for Research and Development), Engr. Robert O. Dizon (Executive Director), Engr. Jonathan Q. Puerto (Deputy Exec. Dir. for Technical Services), Engr. Fred P. Liza
Seated (L-R): Engr. Rommel N. Coroña, Atty. Trixie Hazel C. Veluz, Ms. Aurea T. Motas, Engr. Rea C. Castro, Ms. Lina B. Afable, Dr. Rio S. Pagtalunan

Office of the Executive Director

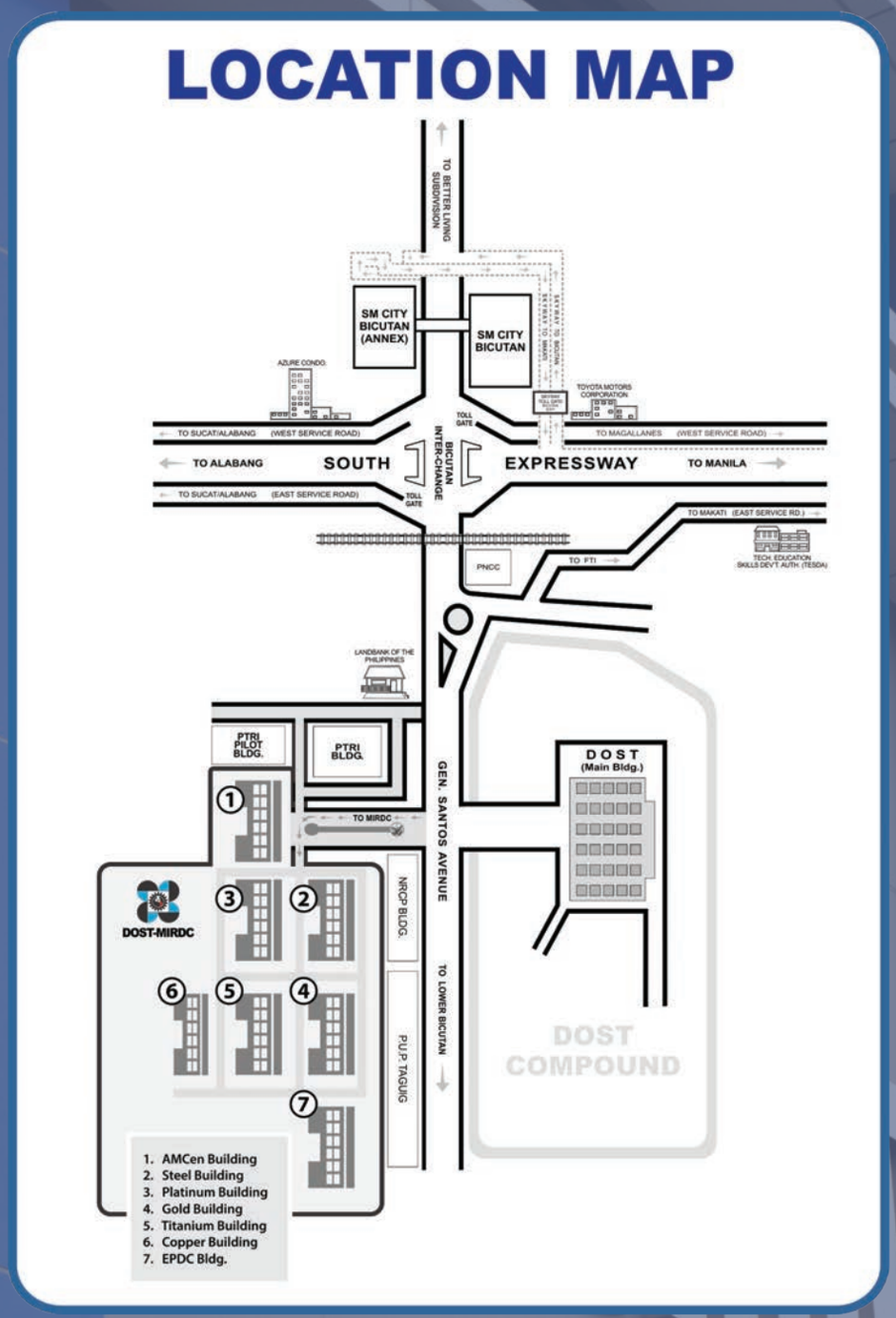
Technical Services Directorate

Research and Development Directorate

Editorial Board

Top: Jonathan Q. Puerto *(Editor-In-Chief)*
(From L-R)
Row 1: Lina B. Afable, Zalda R. Gayahan, Kathlyn Kai H. Negado
Row 2: Jocelyn F. Dime, Eunice A. Bautista, Sharel Shyateza M. Abellar, Linda G. Rivera
Row 3: Alvin M. Buison, Michelle Ann A. Magsalin, Deborah Jaymerci A. Balota, Von Jansen G. Comedia
Row 4: Ronald L. Agustin, Ella Vanesa L. Lopez, Tracy Ann U. Toletino, Christian Glenn S. Ligon

DOST-MIRDC Location Map



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

DEPARTMENT OF SCIENCE AND TECHNOLOGY
METALS INDUSTRY RESEARCH AND DEVELOPMENT CENTER

MIRDC Compound, Gen. Santos Avenue
Bicutan, Taguig City, 1631 Metro Manila
Telephone Nos.: (632) 8837-0431 to 38 (connecting all departments)
Fax Nos.: (632) 8837-0613 and 8837-0430
Website: http://www.mirdc.dost.gov.ph
E-mail: mirdc@mirdc.dost.gov.ph