# Additive Manufacturing Roadmap

**OVERALL STRATEGIES** 

## Needs for Government Facilities and Lab

Continuous support for AMCen

### **Needs for Human Resources**

- Increase awareness of Additive Manufacturing in STEM curriculum, and in industry and among consumers
- Send 10 researchers abroad to raise local talent to global standards by providing exposure and training in renowned research laboratories
- Establish programs to obtain visibility into industryneeds and open channels for collaboration (e.g. internships, immersions)
- Introduce targeted training electives in Additive Manufacturing to promote employment readiness of graduates for certain industry applications
- · Balik Scientist Program to consolidate resources and lead R&D and collaboration efforts in the field
- Improve workforce preparation for opportunities with multinational partners

## **R&D Program / Project Needs**

- Build and publish database with information regarding technology researches, publications, laboratories and equipment, and skills developed
- Partner with at least 10 entities for R&D applications and infrastructure codevelopment

## **S&T Policy Initiatives**

· Ensure communication of government policy incentives and benefits to stakeholders

## 400 M

**AMCen Program** initialized

# **R&D SOLUTIONS**

75 M Small-scale production: post-processing of printed materials Robust vertical wind turbine design Improved hybrid electric road and train components Muffler dry generator Mechanization (Agriculture) Small satellite parts (polymer, metal) Alignment to SRDP (Defense) Knee system, cementless total hip system Surgical instruments for orthopedic procedures Locally available materials for 3DCP

Optimization of properties

materials used in 3DCP

## 430M

Accessible 3D Printers (low materials for AM cost for small-scale Prototype products of manufacturers multiple material AM Materials for ESD Raw materials for AM (Semiconductor) Policy/paper on AM in Ph devices Localized metal powder for materials for 3DCP Multiple materials platform for AM Temperature sensors and sea and wastewater for other basic inland and remote healthcare devices communities Patient specific knee implant, spine implant Metal materials for medical ultrasound impedance matching Development of sharing

## 100M

Database of developed raw membrane distillation system with pumps using hydrophobic membranes) Minimally-invasive surgical patients Database of developed raw Solar water evaporation for clean water production from Upgrading of local printers,

Solar-photovoltaic integrated for water purification (active 3D-printed skin for burn Database/mapping of available equipment in fablabs/centers nationwide

80M

# laser-based localized printers

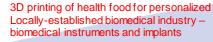
**20M** Inkjet printing for membrane modification (nanofiltration membrane)



Conduct of impact study of the success in adoption of AM in construction Comparative assessment of 3DCP to traditional and modular construction methods used locally 3D-printed membranes for electrochemical energy systems (fuel cells, electrolyzers, batteries)

**50M** 

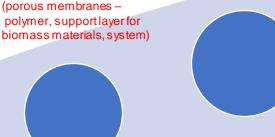
Actual application of 3DCP in construction projects







Provision of enabling technologies for applications beneficial to society.



applications

2025

Tissue Engineering 2026

Advanced capabilities, functionalities and applications (4D Printing / 3D printing with Al)

2027

# 2023

Enhanced capabilities, functionalities and

Procurement of equipment with latest technology or not yet available in AMCen

Equipment: vibration testing (STA, automotive, defense); thermal vacuum (STA)

2024

Equipment: Outgassing (STA)

## Legend (Text Font):



Done

2028

**50M** 

3D Holographic Printing

3D Ultrasonic Printing

3D Bio-Printing

Not yet Ongoing Available

Qualification and evaluation of local materials for AM Local materials studied, utilized. and developed of different types of specifically to suit AM processes Produced and characterized developed AM

75 M

materials

personnel on AM Collaboration / meeting with other agencies and industry partners

240 M

Capacity

building of

## 2020

## 2021

Launching of the Additive Manufacturing (AMCen)

of AMCen services

Additive

Manufacturing

Niche Center initialized

Operationalization Development of business models and pricing for its Development of Additive Manufacturing Standards

# 2022

Additive

manufacturing and materials development Manufacturing, Medical. Building, and Consumer 3D

process for MM-AM. Formulation of raw materials for MM-AM **New MM-AM** 

Optimized

platform for 3DCP

and helmet liners

Local fibers for bicycle parts

Process FEA. materials characterizatio n of AM products. internal inspection (porosity and

wall thickness)

# Policy Development on Environmental and Health Safety on 3D-printed Consumer Products Additive Manufacturing Niche Center established and operational

## **MILESTONES**

## **OVERALL OUTCOME**

Locally-developed products and services intended for Manufacturing, Medical, Building, and Consumer 3D