



INDO-MIM[®]
COMPLEXITY SIMPLIFIED

CORPORATE PRESENTATION



WELCOME



MESSAGE FROM

Krishna Chivukula Jr.

CEO, INDO-MIM

We are a leading global supplier of precision-engineered products using Metal Injection Molding as the core manufacturing technology. INDO-MIM has achieved a leadership position in the field of MIM, providing precision-engineered products to customers in more than forty countries in the Americas, Europe, and Asia.

“INDO-MIM is committed to achieve total customer satisfaction”

ABOUT US



World's Largest MIM Company

85+

Material
Options

32

MPIF
Awards

6000+

MIM Parts
Variety

650+

Customers
Globally



Ship To

Five Continents



150M+

Parts Shipped
Annually



3000+

Employees

MANUFACTURING FOOTPRINT



Over 1.18M sq. ft. of manufacturing in multiple locations in 2 countries



MIM MANUFACTURING FACILITY: BENGALURU

- 0.76M sq. ft. area
- MIM, Machining, Powder Plant & Special Processes
- 700 million parts capacity
- 3000 employees



AEROSPACE SOLUTIONS GROUP FACILITY: BENGALURU

- 0.08M sq. ft. area
- Aerospace Precision Machining & Sub-Assemblies
- 5-Axis Multi-tasking Machines
- NADCAP-approved Special Processes



INVESTMENT CASTING FACILITY: TIRUPATI

- 0.16M sq. ft. area
- Precision Investment Casting, Machining
- 400 employees



MIM MANUFACTURING FACILITY: TX, USA

- 0.14M sq. ft. area
- 90 million parts capacity
- Expandable up to 365k sq. ft.
- 150 employees

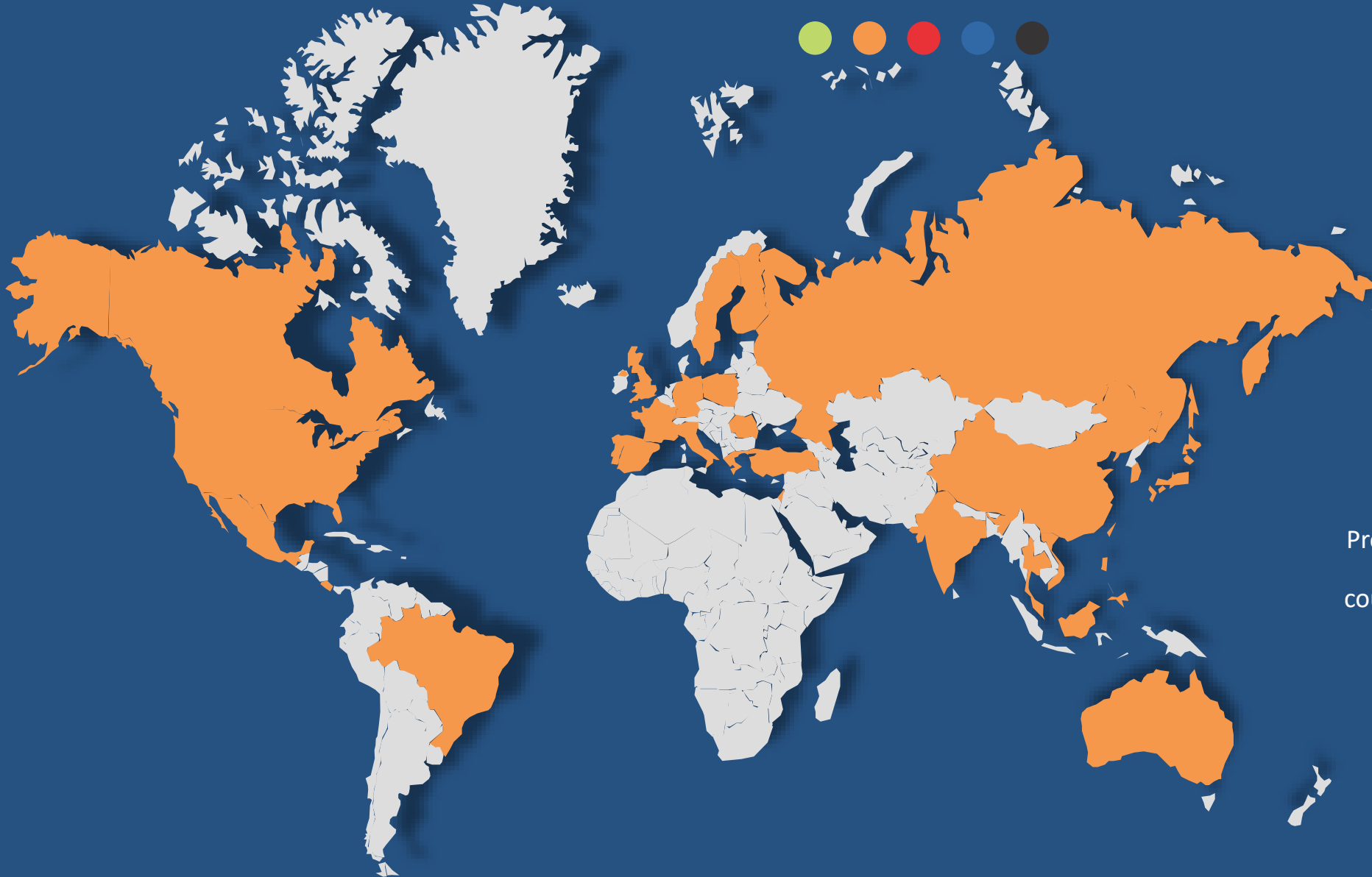


INVESTMENT CASTING FACILITY: AZ, USA

- 0.04M sq. ft. area
- **Triax Castings** – Vacuum Investment Casting foundry specializing in Directionally Solidified (DS), Single Crystal (SC) and Equiax(EQ) casting capabilities

GLOBAL SALES & MARKETING = GLOBAL REACH

20 Years of serving global markets



Providing precision-engineered products to customers in more than forty five countries in the Americas, Asia, Australia and Europe

DIVERSE TECHNOLOGIES



MIM

METAL INJECTION MOLDING

- Largest installed capacity
- Inhouse Tool Manufacturing



CIM

CERAMIC INJECTION MOLDING

- ISO 9001 and ISO 14001 Certified
- Ceramic Cores



IC

INVESTMENT CASTING

- Best in Class State of art Facility
- Air Melt & Vacuum Melt



ASG

AEROSPACE SOLUTIONS GROUP

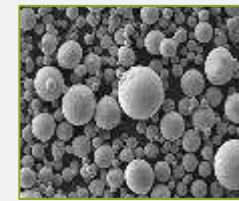
- Precision machining for Aerospace, Oil & Gas, Medical Parts
- NADCAP Certified Surface Treatment



POWDER

POWDER PREPARATION

- Vacuum melting Gas atomized powder production



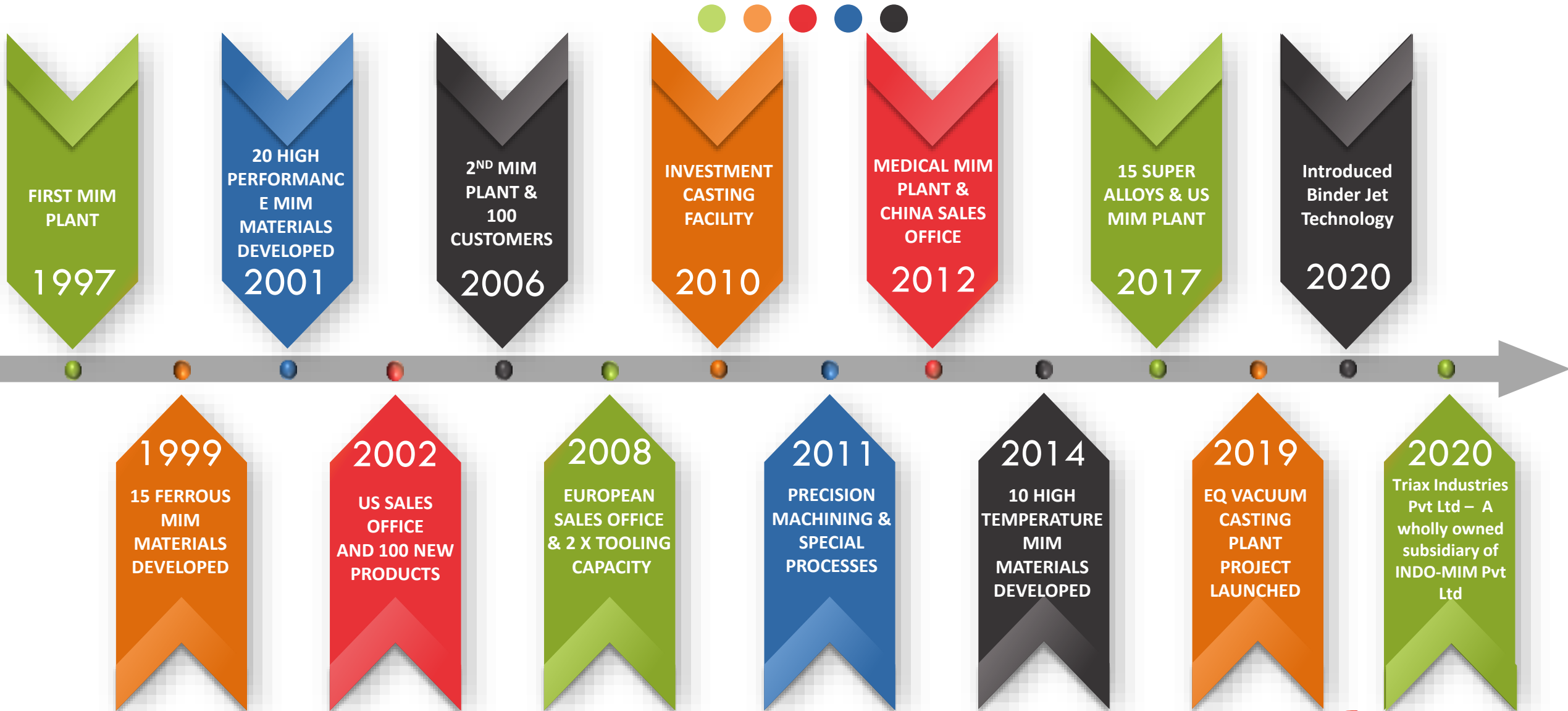
AM

ADDITIVE MANUFACTURING

- Prototyping
- Metal Binder Jet
- Powder Bed Fusion process



HISTORIC TIMELINE

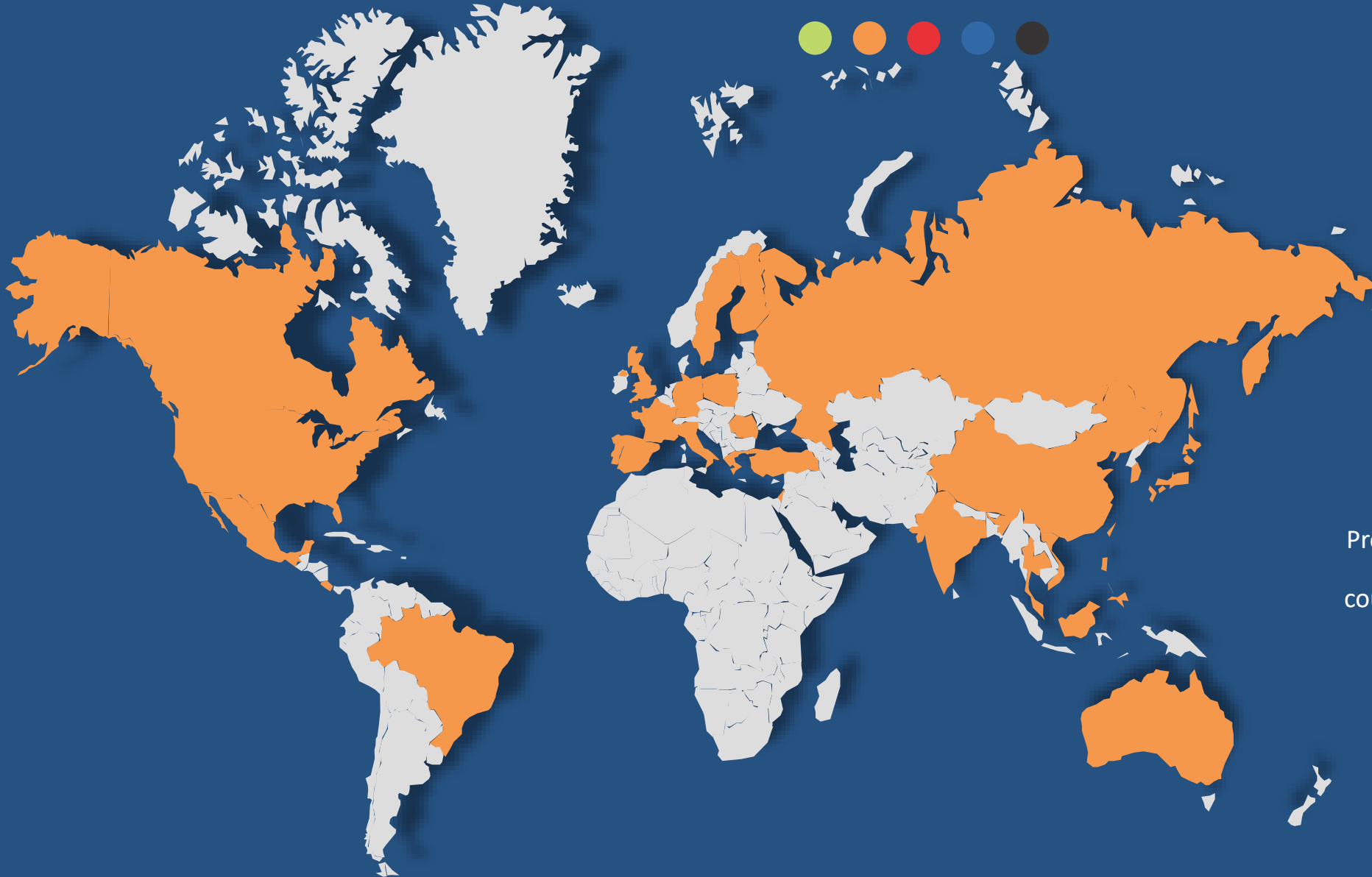


GLOBAL PRESENCE



GLOBAL SALES & MARKETING = GLOBAL REACH

20 Years of serving global markets



Providing precision-engineered products to customers in more than forty five countries in the Americas, Asia, Australia and Europe

CERTIFICATIONS



AS 9100:2016
AEROSPACE

IATF 16949:2016
AUTOMOBILE

ISO 13485:2016
MEDICAL

ISO 14001:2015
ENVIRONMENT

ISO 9001:2016
QMS

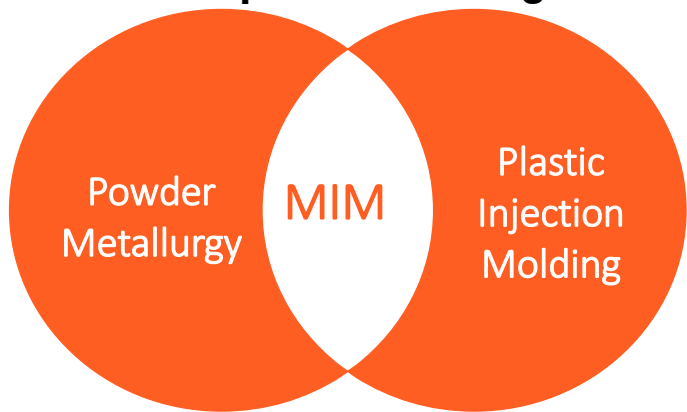
ISO CLASS 8
CLEAN ROOM

OHSAS 18001:2007
HEALTH & SAFETY

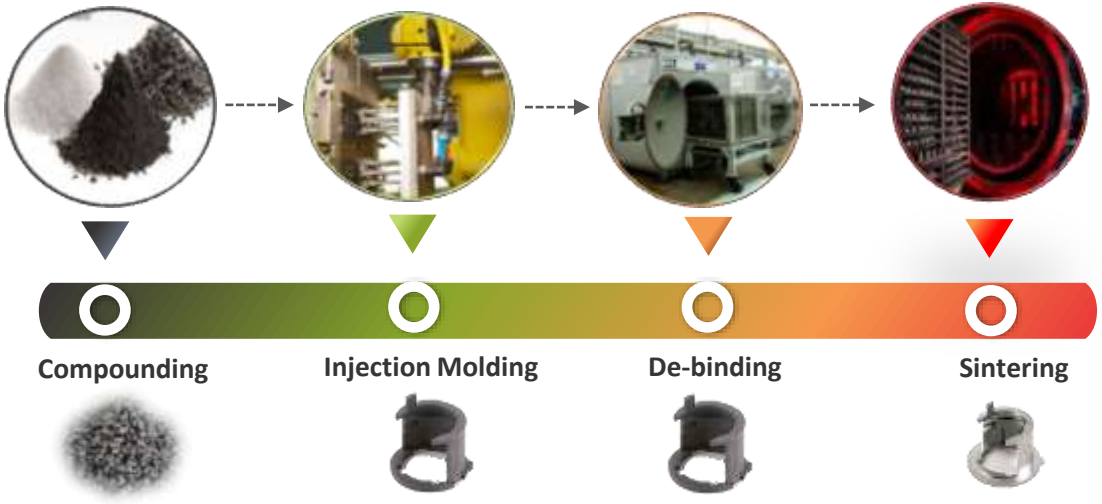
GC-MARK
ENERGY EFFICIENT

MIM PROVIDES THE OPTIMAL BALANCE BETWEEN COMPLEXITY & PRODUCTIVITY

MIM combines Powder Metallurgy and Plastic Injection Molding



MIM Manufacturing Process



Alternate technologies do not provide commercially viable solutions

Parameter	MIM	Other Processes
Ability to handle complex parts	↑ Best suited for highly complex parts with multiple dimensions	↓ Low – Most other processes have limited capability of handling complexity of parts
Ability to mass produce	↑ Ability to mass produce easily as the die/mould once formed can be reused	→ Restricted ability to replicate processes at scale
Commercial viability	↑ Ability to manufacture complex products in a cost effective manner	↓ Costly to manufacture complex products with bulk production volume

ROADMAP - AUTOMOTIVE



GEAR SEGMENT



VANES



LEVER PARK LOCK

AUTOMOTIVE PARTS



HOUSINGS



VALVE BRIDGE



Fuel Injection Pump



Automotive Sensor



Engine



Transmission System



Turbochargers

CASE STUDY – FUEL PUMP ACTUATION



APPLICATION – FUEL ACTUATION

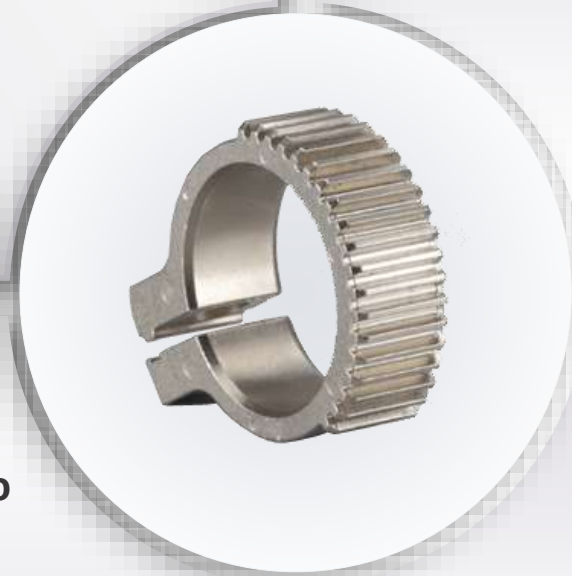


- Entire profile manufactured through MIM
- Large batch production with auto rewinding mechanism for thread in tool

SOLUTION

PRODUCT DESCRIPTION

- Material :- MIM 4605 (Medium Carbon Steel)
- Weight :- 9gm
- Segment :- Automotive
- Annual Requirement :- 3600K



- 6 separate machining operations for every part
- Problem faced in repeatability and burr formation
- High machining cost

CUSTOMER PAIN POINTS

ROADMAP - CONSUMER



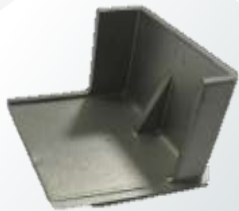
BELAY DEVICE



LOCKS



3C PARTS



CAP



FRONT SUPPORT

CONSUMER PARTS



Locks



Home Appliances



Hand and Power Tools



Mobile Phones



Rock Climbing

CASE STUDY – BELAY DEVICE



APPLICATION – ROCK CLIMBING



PRODUCT DESCRIPTION

- Material :- MIM 17-4PH
- Weight :- 15gm
- Segment :- Consumer
- Annual Required :- 30K



- Near-net shape achieved in the tool itself with all the complex profile features, eliminating all the secondary machining operations

- Complex profile with features like curved profile , undercut and inclined geometry is difficult for conventional machining

SOLUTION

CUSTOMER PAIN POINTS

ROADMAP – MEDICAL



BLADES



JAWS



SOUND TUBES



POSITIONER ARM



CATRIDGE BASE

**MEDICAL
PARTS**



Orthopaedic
Surgery



Cardiac
Surgery



Surgical Stapler



Hearing Aid



Laparoscopy

CASE STUDY – SOUND TUBE



APPLICATION - WIRELESS HEARING AIDS




- Tooling mechanism designed to form curved hole in mold
- All dimensions achieved without machining

SOLUTION

PRODUCT DESCRIPTION

- Material: MIM 17-4PH
- Weight: 3.5gm
- Segment: Medical
- Annual Requirement: 100K



**MPIF AWARD
WINNER – 2014**

- Existing plastic part not ideal for sound transfer
- Manufacturing limitations to achieve design in metal

CUSTOMER PAIN POINTS

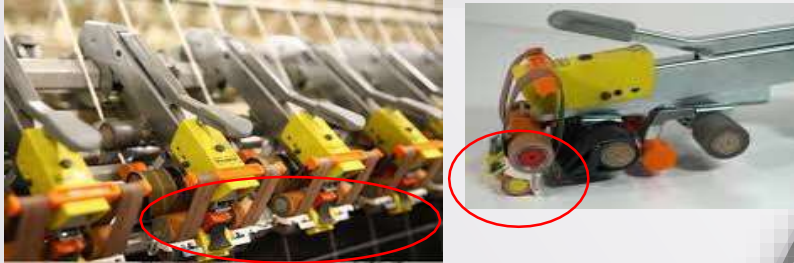
CERAMIC INJECTION MOLDING (CIM)



CASE STUDY – CERAMIC YARN SEPERATOR



APPLICATION – YARN MAKING MACHINE



- Replacing the aluminum to ceramic
- Withstand high temperatures
- Wear and Corrosion resistance
- Complicated profile achievable in mold tool

SOLUTION

PRODUCT DESCRIPTION

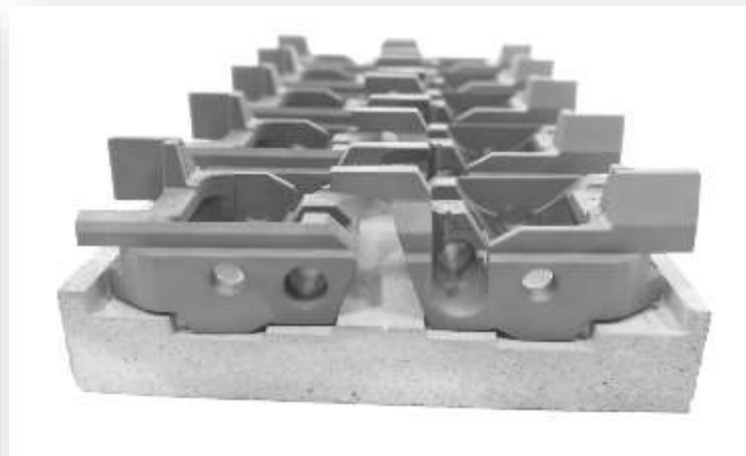
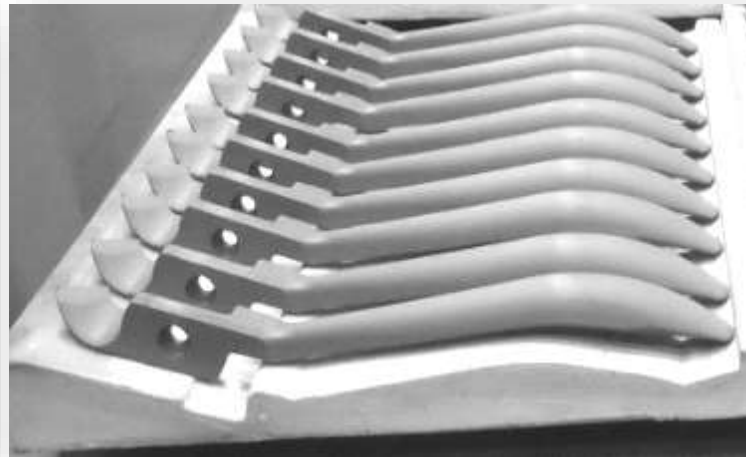
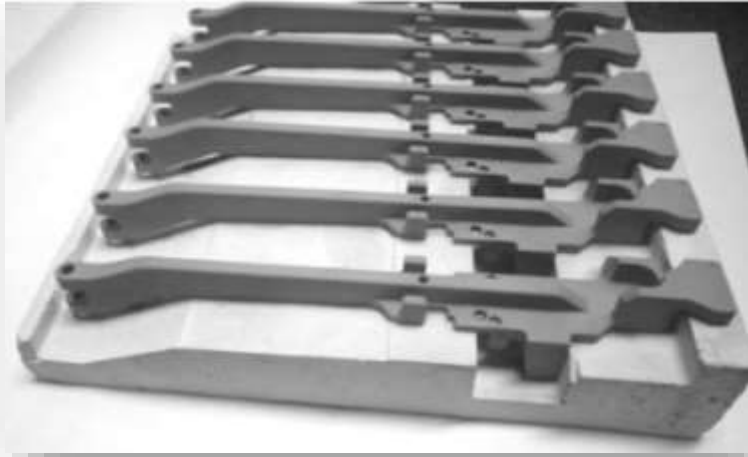
- Material :- 96% of Alumina (Ceramic)
- Weight :- 8gm
- Segment :- Consumer
- Annual Requirement :- 500K



- Wearing of aluminum notch due to high speed yarn spinning method
- Complicated profile at the functional area

CUSTOMER PAIN POINTS

CERAMIC STAGERS



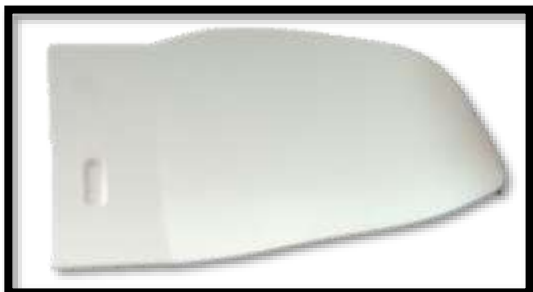
IN-HOUSE CERAMIC SETTERS

Customized staging setters are designed and manufactured for better dimensional control and capability leading to lower post-MIM secondary operations

CERAMIC CORES FOR INVESTMENT CASTING



➤ **Ceramic cores are sacrificial ceramic structures primarily used for forming cavities that are too small or complex to be machined within investing casting procedures**



➤ **Ceramic cores are predominantly found in Aerospace and Industrial Markets**

PRECISION INVESTMENT CASTING



AIR GRAVITY CASTING



VPIC – EQ/DS/ SC CASTING



REVERSE GRAVITY CASTING



ROBOTIC SHELL ROOM



WAX ROOM



FINISH MACHINING



CASE STUDIES – SHIFT FINGER



Challenges resolved by INDO-MIM :

- Achieved precise tolerance for position 0.1-0.4 & also 0.07 with $Cpk > 1.67$
- Achieved cam profile by maintaining good surface finish by minimal machining
- Many of our competitors are doing engravings through machining route. Whereas INDO-MIM can achieve from the process itself thereby providing cost benefits

End use	Engines
Application	Used in transmission of Gears in gear box unit
Material	SCR420
Current customer	Automotive Manufacturer
Annual requirement	120K

Cam profile

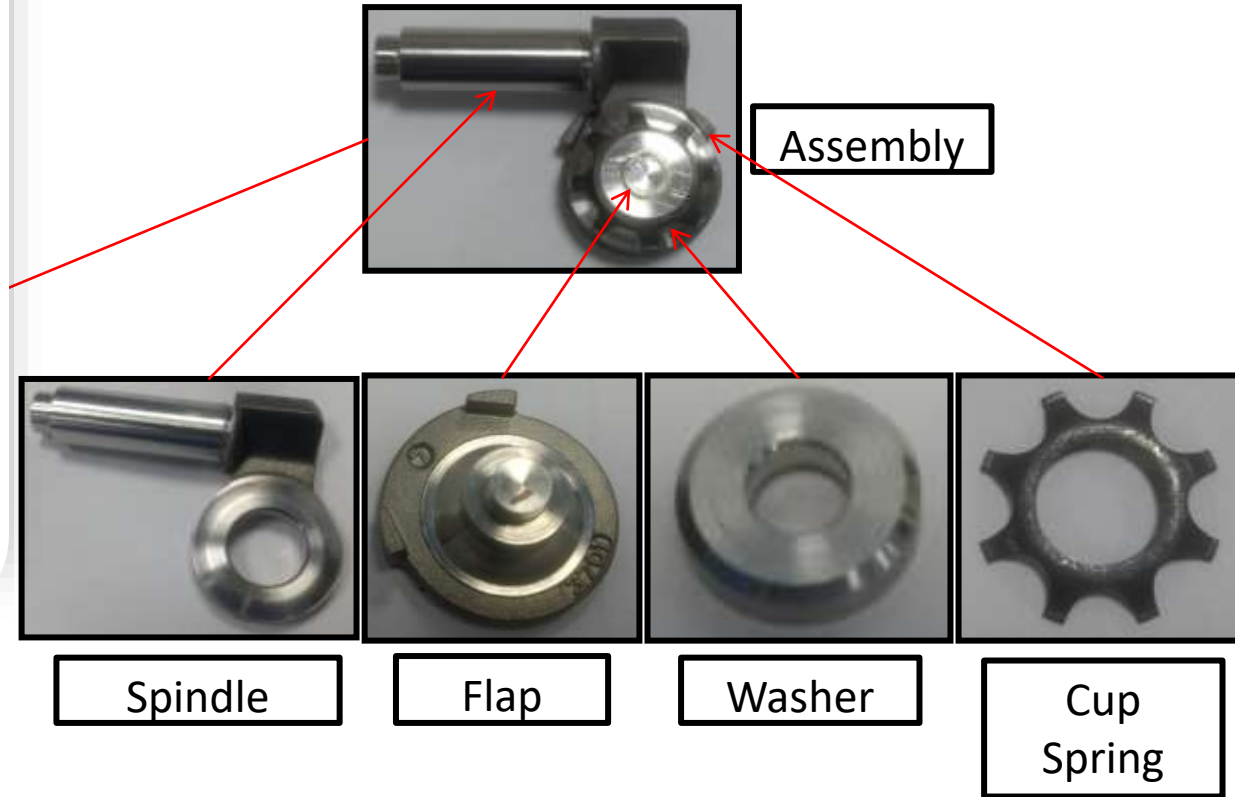


Coulis profile



Shift Finger

CASE STUDIES – FLAP ASSEMBLY



End use	Turbo Engines
Application	Turbo Charger body waste gate valve
Material	Spindle : Din 1.4785 Flap : Din 1.4845 Washer : Din 1.4845
Current customer	Turbo charger Manufacturer
Annual requirement	Flap Assembly : 50 K



**EQ
INVESTMENT
CASTING**

EQ VACUUM MELTING



Upto 650mm Dia and 800mm height molds

Capability - 25Kg and 50Kg melt per charge

Max Temp : 1700°C

Melt Chamber Working Vacuum : $< 1 \times 10^{-3}$ mBar

Best in class process controls



INVESTMENT CAST PARTS PORTFOLIO



- Weight - 10 gms to 500 gms
- Size – 10 mm to 500 mm length
- Wall Thickness - 2 to 20 mm

- Weight - 1 Kg to 20 Kgs
- Size – 300 mm dia & 500 mm length
- Wall Thickness - 2 to 100 mm



MAT'L: IN738LC WEIGHT: 62# TYPE: EQ	MAT'L: FSX414 WEIGHT: 17# TYPE: EQ
MAT'L: CM247LC WEIGHT: 0.3# TYPE: DS	MAT'L: IN792 WEIGHT: 17# TYPE: DS
MAT'L: RENE 80 WEIGHT: 19# TYPE: EQ	MAT'L: CMSX4 WEIGHT: 0.27# TYPE: 5X
MAT'L: IN738LC WEIGHT: 3.5# TYPE: EQ	MAT'L: MM247LC WEIGHT: 2.1# TYPE: EQ
MAT'L: IN100 WEIGHT: 0.04# TYPE: EQ	MAT'L: IN738LC WEIGHT: 1# TYPE: EQ

- Weight - 50 Gms to 50 Kgs
- Size – 30 mm to 500 mm length
- Wall Thickness – 0.5 mm to 25 mm

AEROSPACE SOLUTION GROUP



PRECISION MACHINING EQUIPMENT



CATEGORY	MACHINE	TYPE	CONTROL SYSTEM	AXIS DETAILS
VERTICAL MILLING	Dahlih	VMC	Fanuc	4 axis
	Dahlih	VMC	Fanuc	3 axis
	DMC	VMC	Siemens	4 axis
	DMC	VMC	Heidenhain TNC 620	3 axis
	Okuma	VMC	OSP-P300	4 axis
	Doosan	VMC	Fanuc	4 axis
	DMU	VMC	Siemens	5 axis
	Makino	VMC	Fanuc	4 axis
TURN MILL	DMG	Turn mill	Siemens	4 axis
	Hyundai	Turn mill	Fanuc	4 axis
SWISS MACHINES	Citizen Cincom	Turn mill	Fanuc	6 axis
	Schaublin	Turn mill	Fanuc	7 axis
	Schaublin	Turn mill	Fanuc	3 axis
	Mylas	Turn mill	Mitsubishi	3 axis
	Nexturn	Turn mill	Fanuc	9 axis
TURNING	Takisawa	Turning	Fanuc	2 axis
	HAAS	Turning	HAAS	2 axis
	LMW	Turning	Fanuc	2 axis
	Mylas	Turning	Mitsubishi	2 axis
HORIZONTAL MILLING	DMC	HMC	Siemens	4 axis
	HAAS	HMC	HAAS	4 axis
MILL TURN	Okuma	Mill turn	OSP-P300	5 axis
OTHER	Okomoto	Surface Grinding	Fanuc	N/A
	BGS	Centerless Grinding	N/A	N/A
	Jones & Shipman	Cylindrical Grinding	N/A	N/A

PARTS PORTFOLIO



- Many product lines recognized by our customers as Centers of Excellence (COE)
- Commercial: On both NARROW BODY and WIDE BODY programs including Airbus A220, A320neo, A330, A350, Boeing 737 MAX, 777X, 787 Dreamliner
- Defense: AH-64 Apache, CH-47 Chinook

Material: Inconel 625/718, Titanium, SS 347, Al 6061
Key Characteristics: ID 0.0005"
Special Process: Anodize, Painting



Material: Inconel 718, Waspaloy, Toughmet, 17-4 PH, Castings
Key Characteristics: ID 0.0002"
Special Process: NDT, Passivation, Zinc Nickel plating



Material: 13-8 PH, A286, 17-4 PH, Al 6061 / 7075
Key Characteristics: Position 0.0001"
Special Process: NDT, CCC, Cadmium plating, Passivation, Painting



PARTS PORTFOLIO - CONTINUED



Material: Al 7075

Key Characteristics: Position 0.001" & Hole (Ø 0.8") tolerance: 0.0003"

Special Process: NDT, Chemical Conversion



Material: Al 6061

Key Characteristics: Total Run out 0.001" & Hole (Ø 0.18") tolerance: 0.0003"

Special Process: NDT, Chemical Conversion



Material: AMS 5645

Key Characteristics: complex machining, assembly of stud

Special Process: NDT, Cleaning



Material: Casting Steel

Key Characteristics: Casting machining

Special Process: NDT



NADCAP-APPROVED SPECIAL PROCESSES

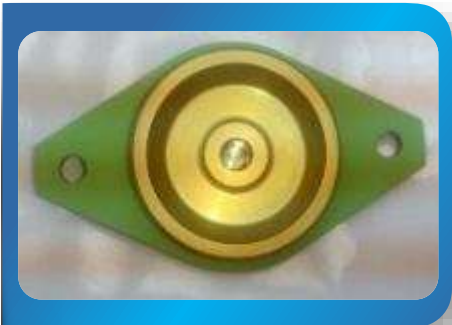


SL. NO.	PROCESS	AS 9100	NADCAP	AIRBUS (80-T)	Boeing	Bell Helicopter	Elbit Systems	Halliburton	IAI	MBD (Safran)	Moog	Parker	PWA	PWC	Rafael	Rolls Royce	Thales	Collins Aerospace	CESA	Woodward
1	Alodine (CCC)	✓	✓		✓	✓	✓		✓	✓	✓				✓		✓	✓	✓	✓
2	Passivation	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓	✓
3	NDT - FPI	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓
4	NDT - MPI	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓
5	Cadmium	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓				✓	✓	✓
6	Hard Chrome	✓	✓				✓	✓	✓	✓	✓	✓	✓					✓	✓	✓
7	Chromic Acid Anodizing	✓	✓		✓	✓	✓		✓	✓	✓		✓		✓		✓	✓	✓	✓
8	Sulphuric Acid Anodizing	✓	✓			✓	✓		✓		✓		✓	✓	✓		✓	✓		✓
9	Hard Anodizing	✓	✓				✓		✓		✓						✓	✓		✓
10	Boric - Sulphuric Acid Anodizing	✓	✓		✓															
11	Zinc Nickel	✓	✓						✓		✓		✓							
12	Electroless Nickel	✓	✓				✓													✓
13	Paint	✓	✓	✓	✓		✓		✓		✓		✓		✓		✓	✓		✓
14	Heat Treatment	✓						✓												
15	DFL / SFL	✓	✓		✓		✓		✓		✓		✓					✓		

We are LCS (Laboratory Control at Source) approved by Pratt & Whitney America



SPECIAL PROCESSES CAPABILITIES



Landing Gear pistons and cylinders for Airbus A350, A330/340, A320neo, A380 & Boeing 787 programs

WELDING FACILITY



SECTORS

Defense, Aerospace, Medical, Automobile & General Engineering

PRODUCTS

Sheet metal, Machined components, Castings, Tubes and Pipe welding

FACILITY

- 2200 Sq.ft Temperature-controlled Welding shop
- Fronius MagicWave 4000 machine – GTAW (TIG)
- Two axis welding positioner
- Pre & post weld facility

MATERIAL CAPABILITY

- Aluminum and its alloys
- Titanium and its alloys
- Nickel and its alloys
- Stainless steel
- Carbon and Mild steel

THICKNESS CAPABILITY

- Aluminum & its alloys – 1 mm to 25 mm
- All other materials – 0.7 mm to 25 mm



WELDING MACHINE



ROBOTIC WELDING-NOV'22



2-AXIS POSITIONER

FACILITY FOR METAL POWDERS



600 tons of melt capacity per annum

A

Vacuum melting – Hot Inert / Nitrogen gas atomization

B

ASB features enhance the **Powder Sphericity**

C

100 tons of capacity / year for AM grade powders. Planned to enhance capacity to **300 tons/annum** in 2022

D

Capable to handle **Ferrous alloys, Nickel and Cobalt** super alloy powders

E



POWDERS IN OUR BASKET



STAINLESS STEEL

SS 316L
17-4 PH
15-5 PH
SS 304
SS 321
SS 310
SS 420

ALLOY STEEL

MA 300
H13
M2
D2

NICKEL ALLOYS

IN718
IN713C
IN625
NMC 80A

COBALT ALLOYS

T400
T800
F75
Co-Cr1
STL 6
HAY 25

METAL BINDER-JET 3D PRINTING



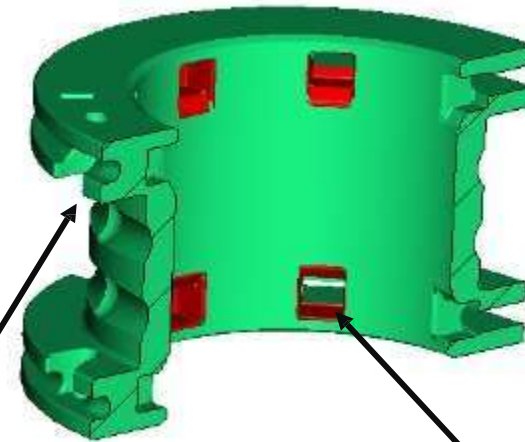
- ✓ Green and sintered density is determined by the particle size distribution of the powders
- ✓ The Powder Processing Unit is used primarily to facilitate recyclability of the powders and ensuring the uniformity of the particle size distribution



METAL BINDER JETTING PARTS



CASE STUDIES: BINDER JET AND MACHINED...



External grooves (2 mm width)

Internal undercuts

Minimum wall thickness : 1.90 mm Volume
of the part : 19249.02 mm³
Weight of the part : 132 gms

Part complexity :

- Part has **external grooves** on both top and bottom face (2mm width on each)
- Also has **internal under cuts** makes it difficult to produce through MIM process or any other process
- These kind of parts are ideal candidates for Binder jet process

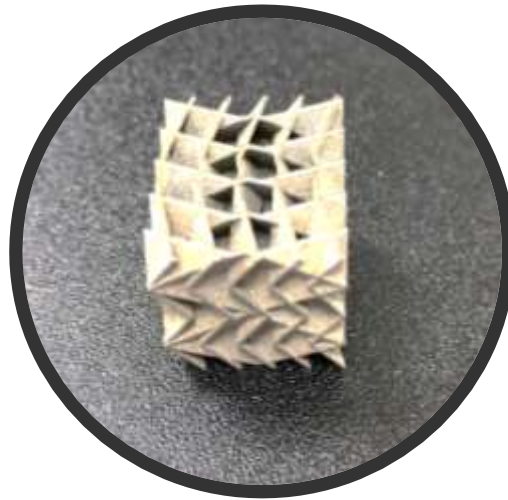
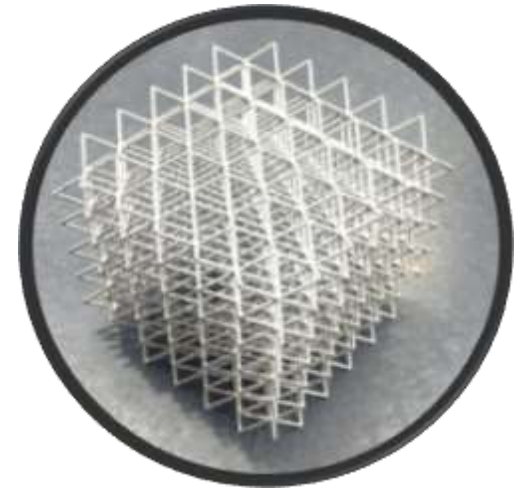
LASER POWDER BED FUSION 3D PRINTING



- ✓ Recently added Powder Bed Fusion 3D printing capability
 - Build volume of 150 mm dia * 180 mm height
 - Materials supported include Inconel (625, 718), Stainless Steel (316L, 410L, 17-4PH), 18Ni300, HK30, Cobalt Chrome Alloys (Co-Cr-Mo, Co-Cr-W-Mo)
- ✓ Vertically integrated with our own metal powder manufacturing capability



PORTFOLIO OF 3D PRINTED PARTS (LPBF)



SUB-ASSEMBLY PROJECTS – AUTO & CONSUMER



Audio Ear rings



Hydraulic system



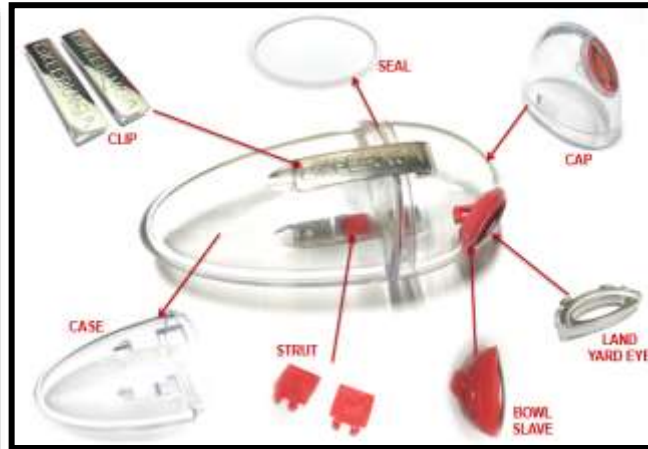
Nipper



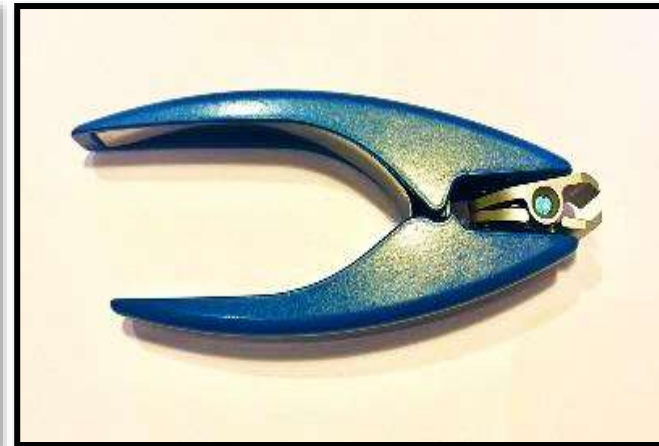
Hinge in Caravan



Hand Tools



Water Proof Key Case



Nail Clipper



Power Tool

UNIQUE DIFFERENTIATORS



OPERATIONS

- High degree of automation
- 30% capacity allocated for DCNs/ECNs & maintenance



SALES & MARKETING

- Global network
- Overseas sales & marketing support
- 24 x 7 service



PROCESS DEVELOPMENT

- Depth & breadth in all processes to launch small to high volume programs
- Ability to develop processes and ship them to global locations



SUPPLY CHAIN

- Well developed and scalable internal as well as external low-cost supply chain



MATERIALS

- 85 + MIM Materials
- Advanced Super alloys
- Constant R & D effort



SUSTAINABILITY INITIATIVES



- ✓ We at INDO-MIM always strive towards protecting environment including pollution prevention and emission reduction
- ✓ 97 % of our energy consumption is achieved through green energy
- ✓ Optimization of DG set utilization through PLC Automation & Solar Power to achieve CO2 Reduction
- ✓ 5000 saplings planted to make a mini-forest to help offset carbon footprint



CORPORATE SOCIAL RESPONSIBILITY



INDO-MIM group companies proudly support a variety of charitable organizations that share our vision of making a positive contribution to the society



Mid Day Meal Scheme

Through the local schools, INDO-MIM feeds over 2,500 students in the mid day meal scheme.



The Chivukula Wing

The Chivukula wing was built at the Bangalore Baptist Hospital Through Support from Mr. Chivukula. Annual contributions to support treatment needs for the disadvantaged have been provided.



Asha Foundation

INDO-MIM continues to support the Asha foundation in the fight against HIV/AIDS in India.



Deenabandhu & Vishranthi Trust

INDO-MIM extends its support towards rural education through the Deenabandhu Trust. It also supports the welfare of the old and the orphans through the Vishranthi Trust.

MORE THAN 3000 HEARTS – ONE BEAT

Creating Value :

In-depth technical competence

International presence

Application and Industry Expertise

Long-term Relationships

THANK YOU

www.indo-mim.com

 [/company/indo-mim-pvt-ltd](https://www.linkedin.com/company/indo-mim-pvt-ltd)

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