ARISTO CAST
INVESTMENT CASTING

ADVANCED TECHNOLOGY CENTER

12
Mg
24.305

MAGNESIUM
SOLUTIONS


RESEARCH
DEVELOPMENT

Awards

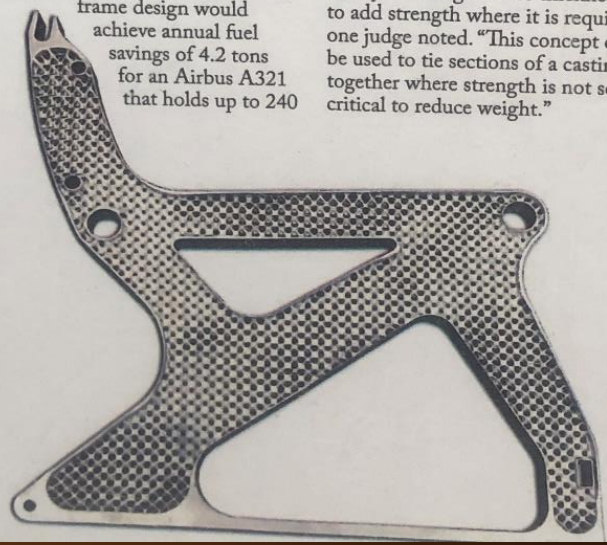
American Foundry Society
2017
Casting of the Year
Metal Casting Design & Purchasing

Material: Magnesium.
Process: Investment casting.
Weight: 1.7 lbs.
Dimensions: 17.4 x 17 x 0.8 in.
Application: Lightweight seat-back frame supporting passenger seats in aircraft.

frame with a lattice-like structure and voids where material was not required for strength. To machine the design would be costly and time consuming. The new shape was a perfect fit for investment casting.

Aristo-Cast took the lattice-shaped design and adjusted it based on casting requirements and solidification principles to achieve the detail. Cast in magnesium, the new seat frame design would achieve annual fuel savings of 4.2 tons for an Airbus A321 that holds up to 240 seats. Based on current fuel costs for jet fuel, average annual savings would be $12,935 and life-of-service savings (25 years) would be $323,375,000 per plane. For an Airbus 380 with 616 seats, annual fuel savings was calculated as 13 tons a year for an annual savings of $40,040 and life-of-service savings of $1,001,000.

"The casting design showcases the ability to change lattice thicknesses to add strength where it is required," one judge noted. "This concept can be used to tie sections of a casting together where strength is not so critical to reduce weight."



Press Release

Part 1

ADMATEC
Additive Manufacturing Technologies

+31 13 530 08 98
info@admateceurope.com
www.admateceurope.com

New process developed with the Admaflex 130
With the Admaflex 130 it was possible to directly print the shell thus eliminating the need for a costly injection mold or a costly 3d printed pattern. This means that Aristo-Cast was able to remove five steps of the traditional process, including:
Step 1: Creation of Pattern
Step 2: Cluster patterns
Step 3: Cluster dipped in ceramic slurry (repeated several times)
Step 4: Stucco coat forming (repeated several times)
Step 5: Dewax shell mold
Furthermore, printing the shell directly from a cad file eliminated the doubt of what the surface detail looked like and allowed the inspection of intricate core passages before the alloy was poured. The issue related to coat drying was completely removed allowing a much faster creation of the shell. In some cases reducing the time by 75%.

Why this was not possible with previous additive manufacturing technologies?
"The Admatec 3d printer has taken the investment casting prototype manufacturing to the next level. Its simplicity and ease of operation is unmatched compared to traditional pattern 3d printing." - Jack Ziemba

Firstly, the Admatec team worked closely with Aristo-Cast in order to tailor the ceramic formula to match the required shell formulation. Resulting with Admatec developing a material for investment casting suitable for additive manufacturing and compatible with the process to successfully 3d print Shells. Secondly, the combination of the material with the DLP technology used by Admatec enabled Aristo-Cast to print intrinsic geometries with high accuracy and extremely thin wall thickness.

Jack Ziemba, explains that – *"the reduction in material used, allowed a more consistent isotropic shrinkage of the final part and the ability to print a perfect hollow surface from the inside of the Shell allowing an easier removal of the core."* - he adds – *"with the Admatec technology, anybody that is able to melt metal could be an investment caster"*

"Here at Admatec we strive to assisting customers with custom made solutions through our expertise in material and machine development. If you're looking for a partner to improve or develop new solutions with ceramic and metal additive manufacturing, we'd like to hear from you!" - Jaco Saurwalt

Cost savings with the new process:
The savings in costs vary widely, being determined by the complexity of the part produced, but can be as much as 50% less than a traditionally produced casting. Admatec investment casting solutions are now open to the market. For more information please contact info@admateceurope.com.

"We're only scratching the surface on the advantages that shell printing can bring." - Jack Ziemba

Aristo-Cast will present the new investment casting approach developed with Admatec, at AMUG Conference in Chicago. Join us on Tuesday April 2nd, from 1:30 to 2:30 PM, room: PDR 2.

ADMATEC
Additive Manufacturing Technologies

+31 13 530 08 98
info@admateceurope.com
www.admateceurope.com

Press Release

Admatec and Aristo-Cast jointly present new pattern-less investment casting process with additive manufacturing

UNDER EMBARGO TILL 30TH OF MARCH 2019

Admatec, is a Dutch based company pioneering ceramic and metal 3d printing using their in-house developed ADMAFLEX technology and materials including ceramics such as Alumina, Zirconia and Fused Silica; and metals such as 316L, 17-4-PH, Inconel 625 and Copper.

Aristo-Cast, is an award-winning investment casting company that is recognized as a leader in applying additive Manufacturing technology to the investment casting process. They have been producing 3d printed wax patterns since 1998.

30th of March 2019, Alkmaar, The Netherlands - In 2017, Aristo-Cast started working with the Admaflex 130 ceramic 3d printer to develop a new process that would revolutionize the traditional investment casting process. The Admaflex 130 3d printer was developed in 2012 by Admatec.

"We've been working with Admaflex 130+ Ceramic 3d printer for approximately 18 months. During that time, we developed a process that will allow us to revolutionize the investment casting process." - *Jack Ziemba*

Current method of creating investment casting:
The conventional, method of creating investment casting consists of either injecting or 3d printing a pattern that is invested in a ceramic coating to create a ceramic shell. The pattern is then burned out from the ceramic, leaving a cavity that will be filled with the alloy of choice to produce a close tolerance casting.

Challenges of Conventional Investment Casting (IC) process:
The conventional IC process is very labor intensive and time consuming and takes anywhere from two to as many as ten days to create a shell that is ready for casting. The shell is created by dipping the pattern in a liquid slurry and subsequently drying each coat before adding the next of as many as 8 coats to complete the shell. The first coating being the most critical, due to the fact that it's the determining factor in the fine detail and surface finish of the final product. A pattern with complex cores or passages is the most challenging to dip due to the inability to verify the integrity of the coat and the difficulty in determining when the coat is sufficiently dry to allow the application of the next coat.

Hamsterkoog 7 | 1822 CD Alkmaar | The Netherlands

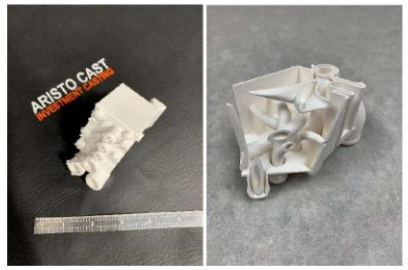
Press Release

Part 2

ADMATEC
Additive Manufacturing Technologies

+31 13 530 08 98
info@admateceurope.com
www.admateceurope.com

Images of 3D printed Shell on the Admaflex 130:

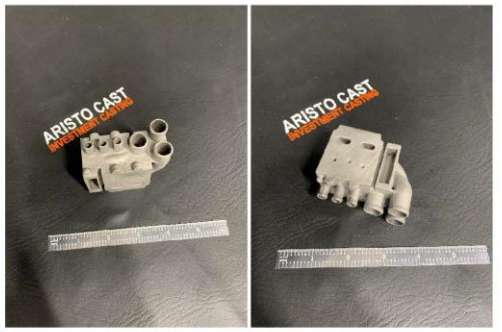


Cross section view of the shell

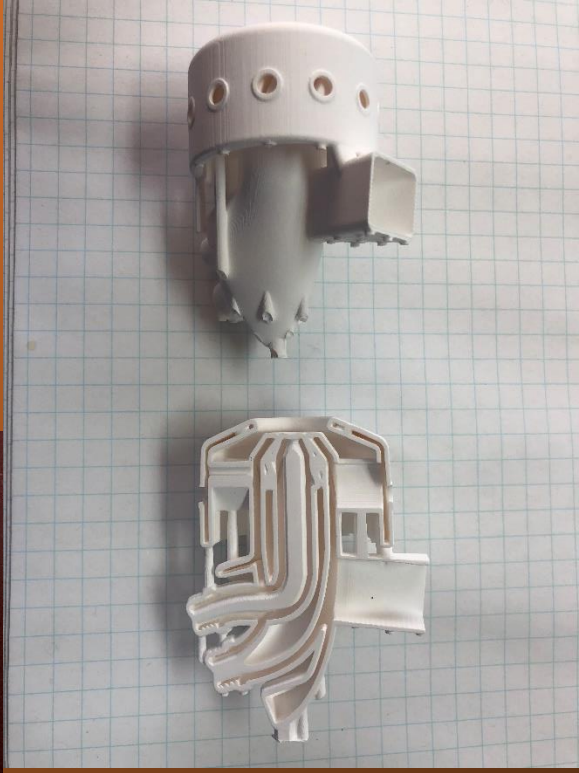
ADMATEC
Additive Manufacturing Technologies

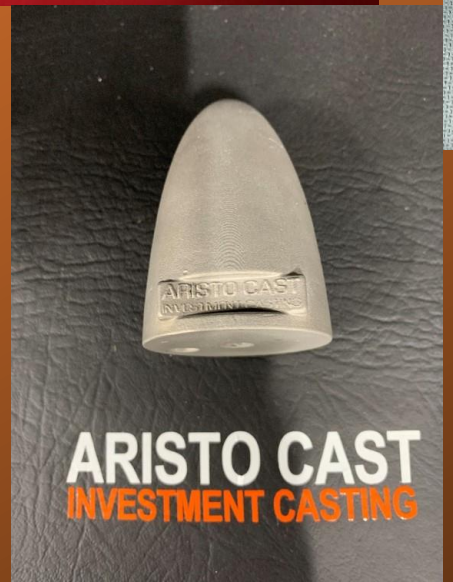
+31 13 530 08 98
info@admateceurope.com
www.admateceurope.com

Images of Metal Cast:

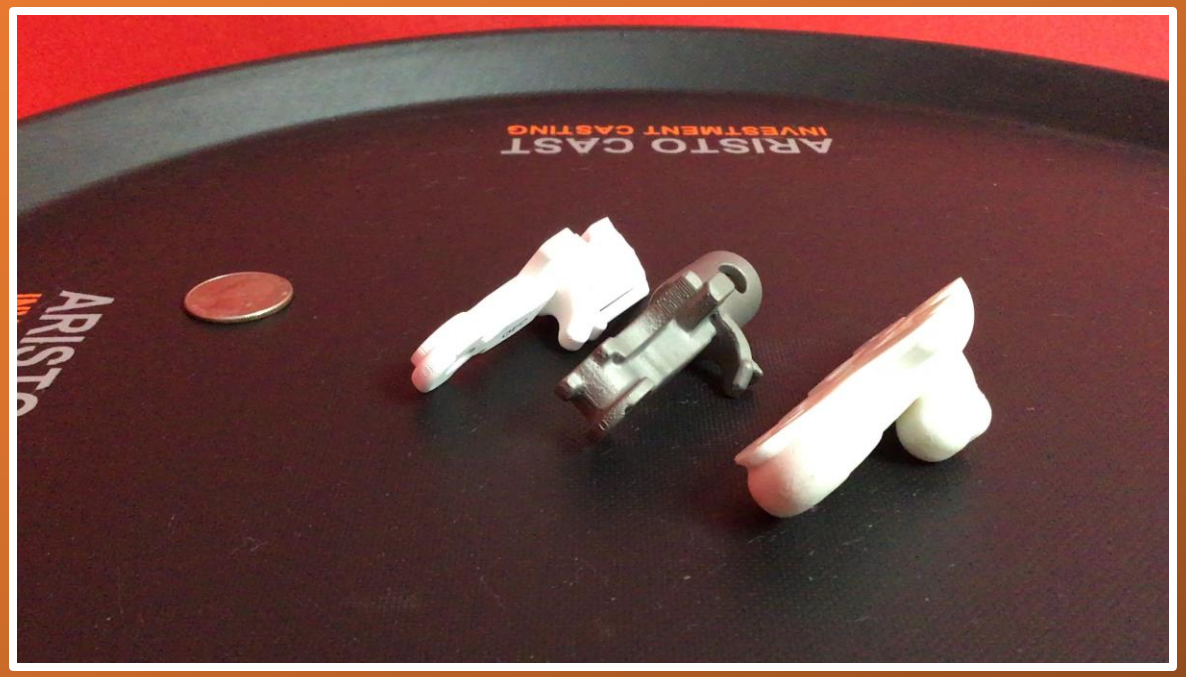


PICS Samples

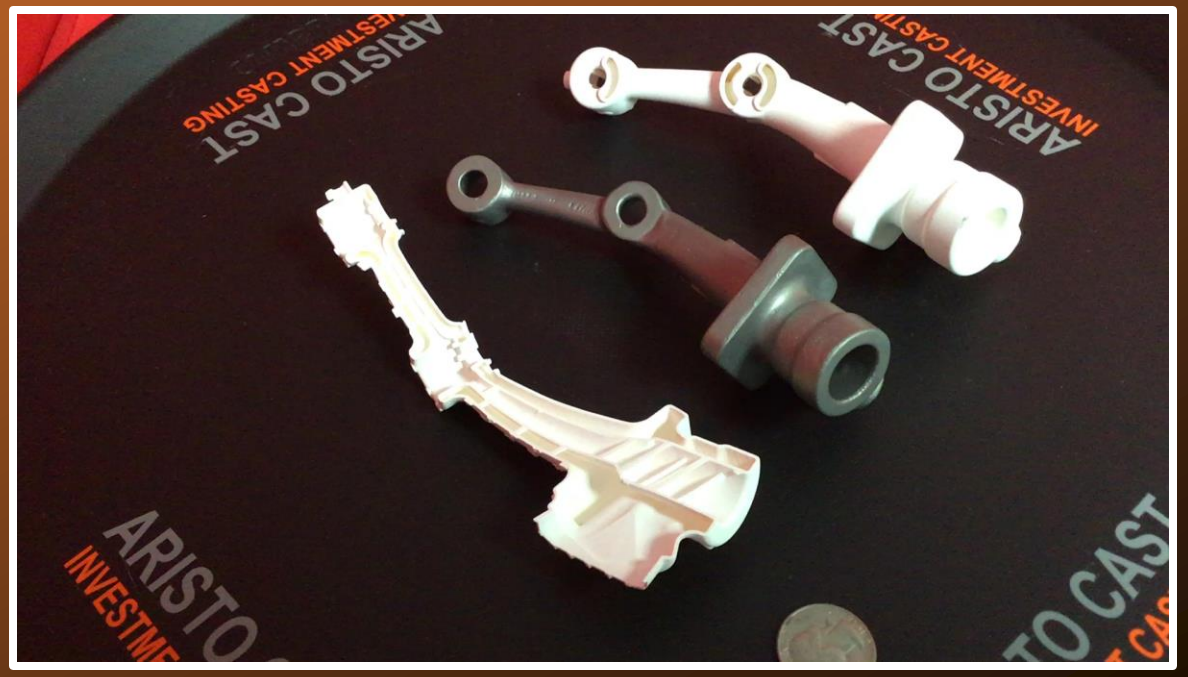




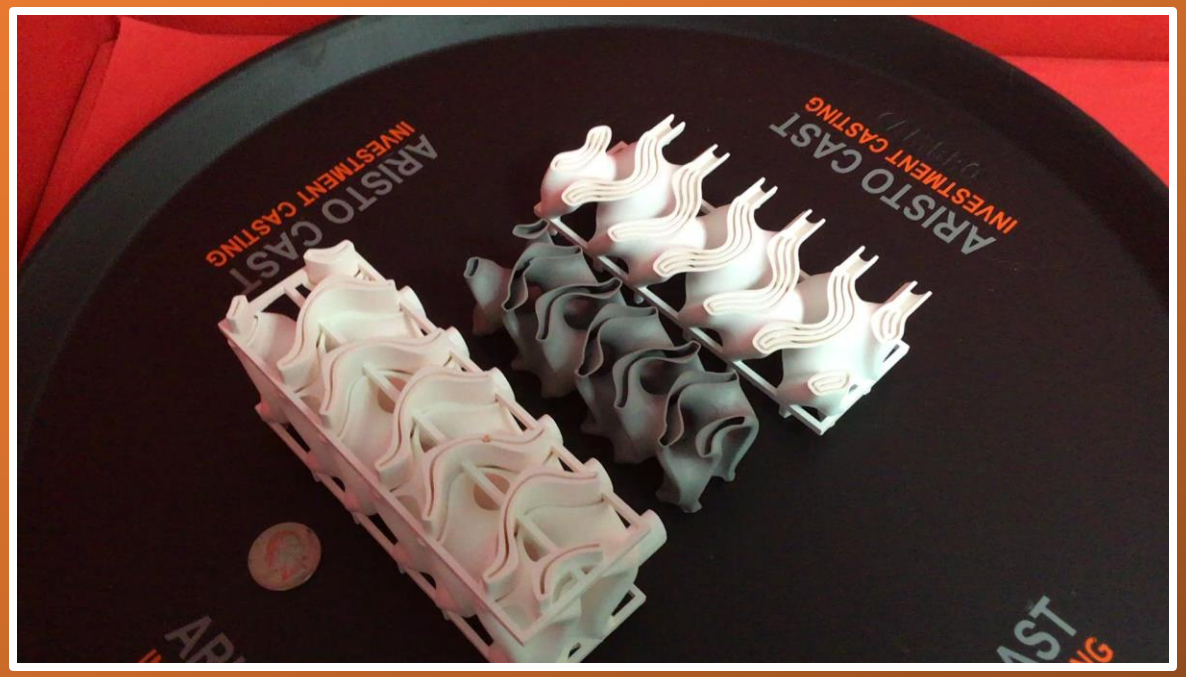
Benchmark



Complex Nozzle

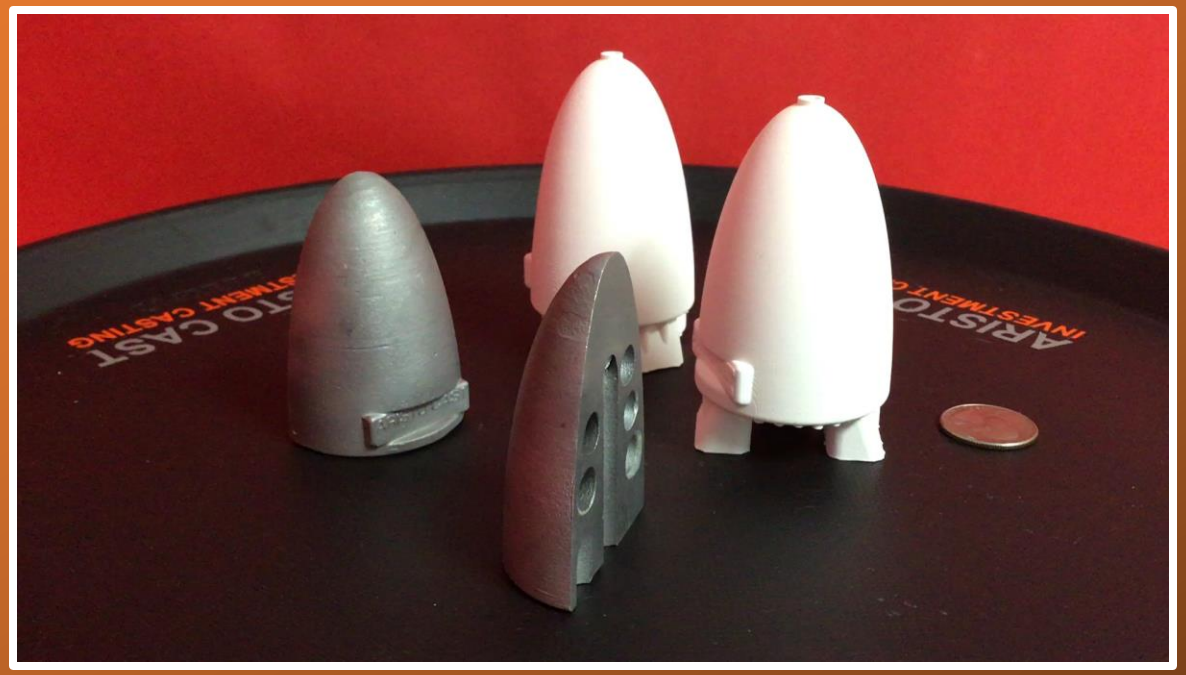


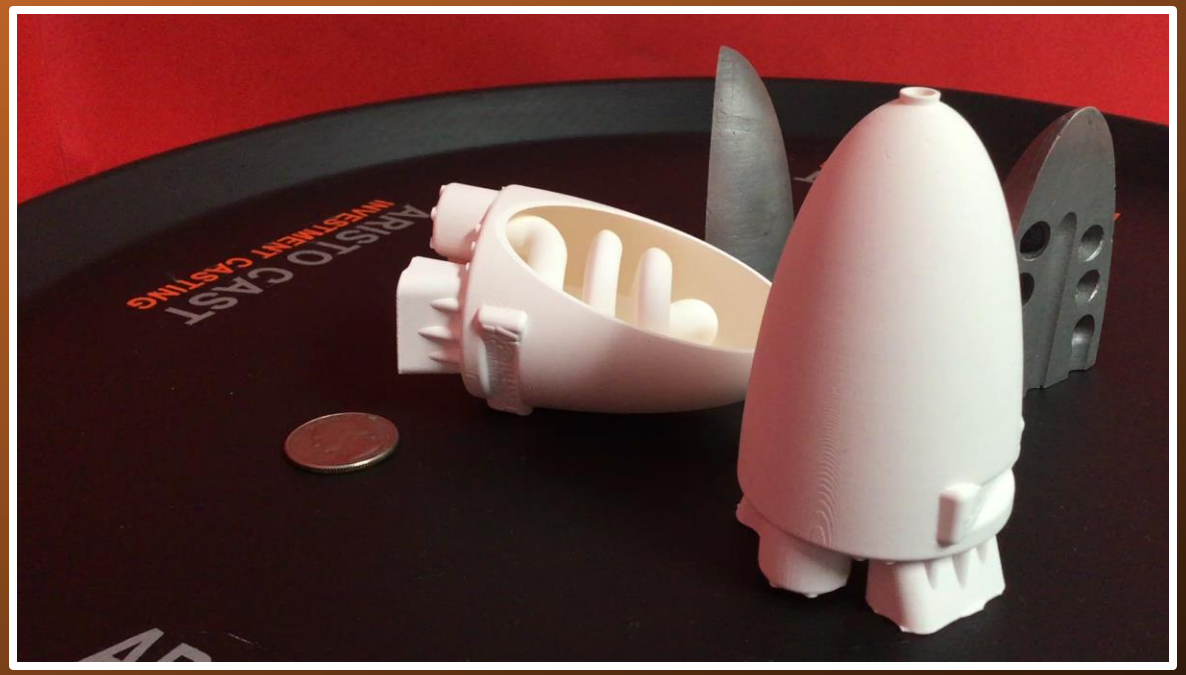
Gyroid



Vibrating Horn

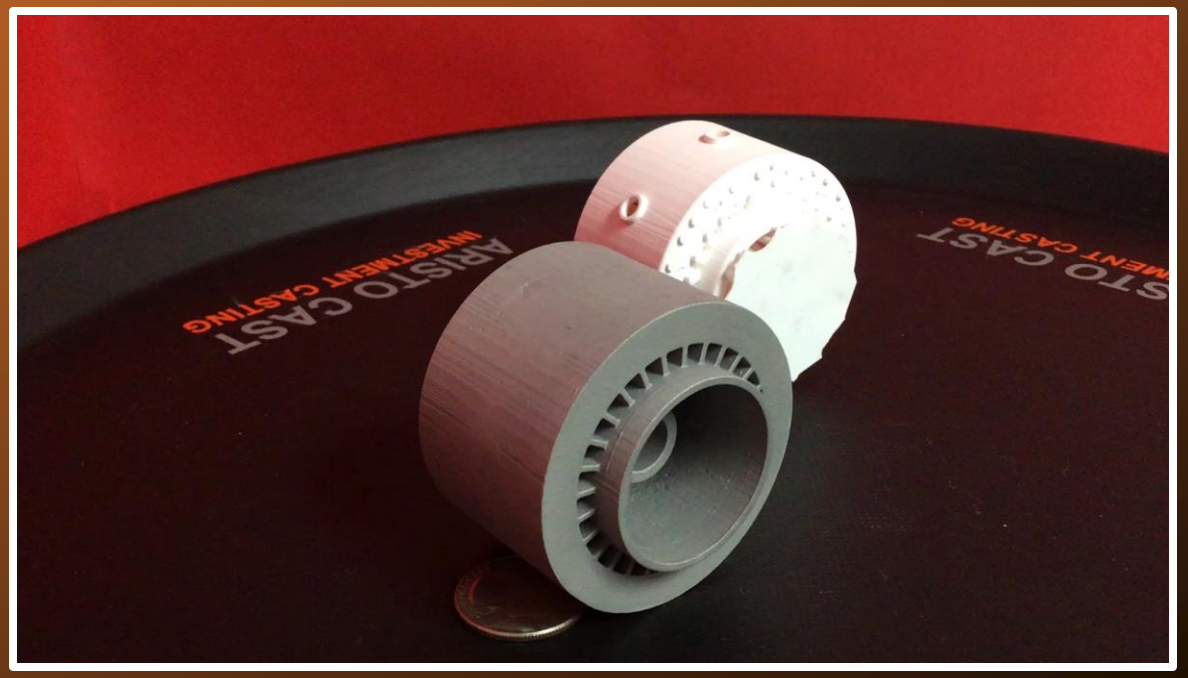
Conformal Cooling Egg



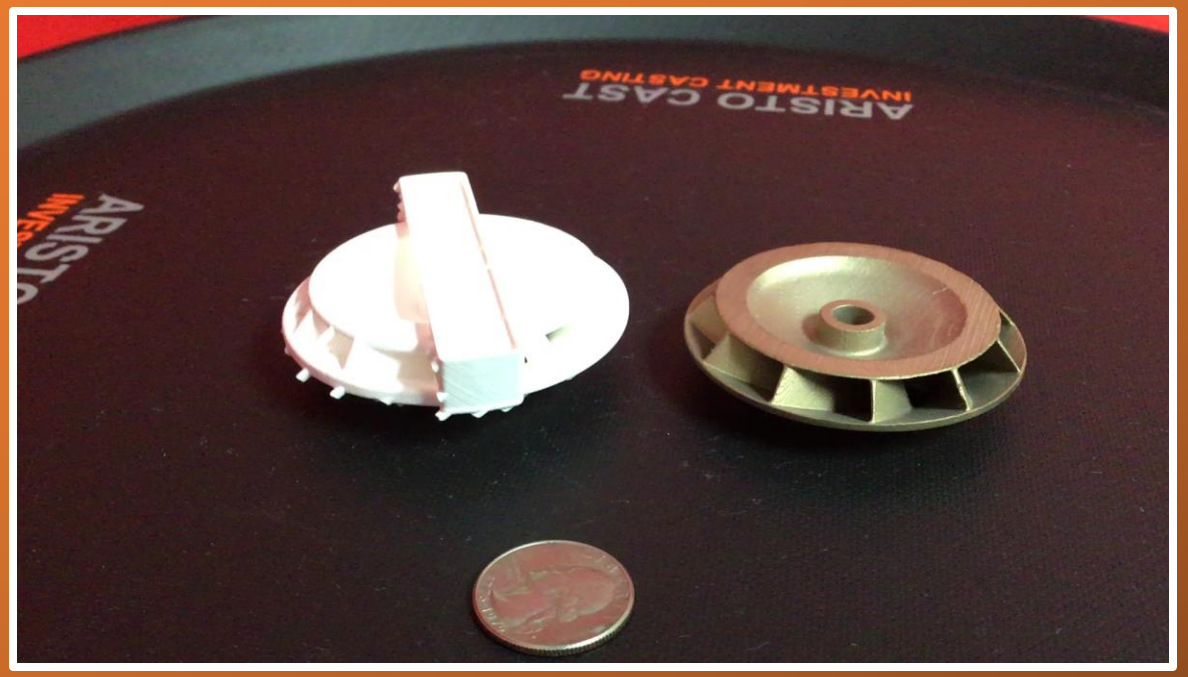


Swirling Manifold

Straight Turbine



Impeller



Turbo Housing

Advantages of PICS Process

- No tooling
- No wax room labor – benefits
- No wax press or wax costs
- No pattern etching
- No extreme care applying 1st coat
- No extended dry time – deep detail
- No Autoclave
- No wax reclamation cost
- No flash fire or burnout smoke
- Ability of inspect shell integrity and deep cores prior to cast
- Ability to control shell thickness in design stage (chill or insulate)
- Faster dip room throughput
- Lighter shells – no wax weight

PICS Room

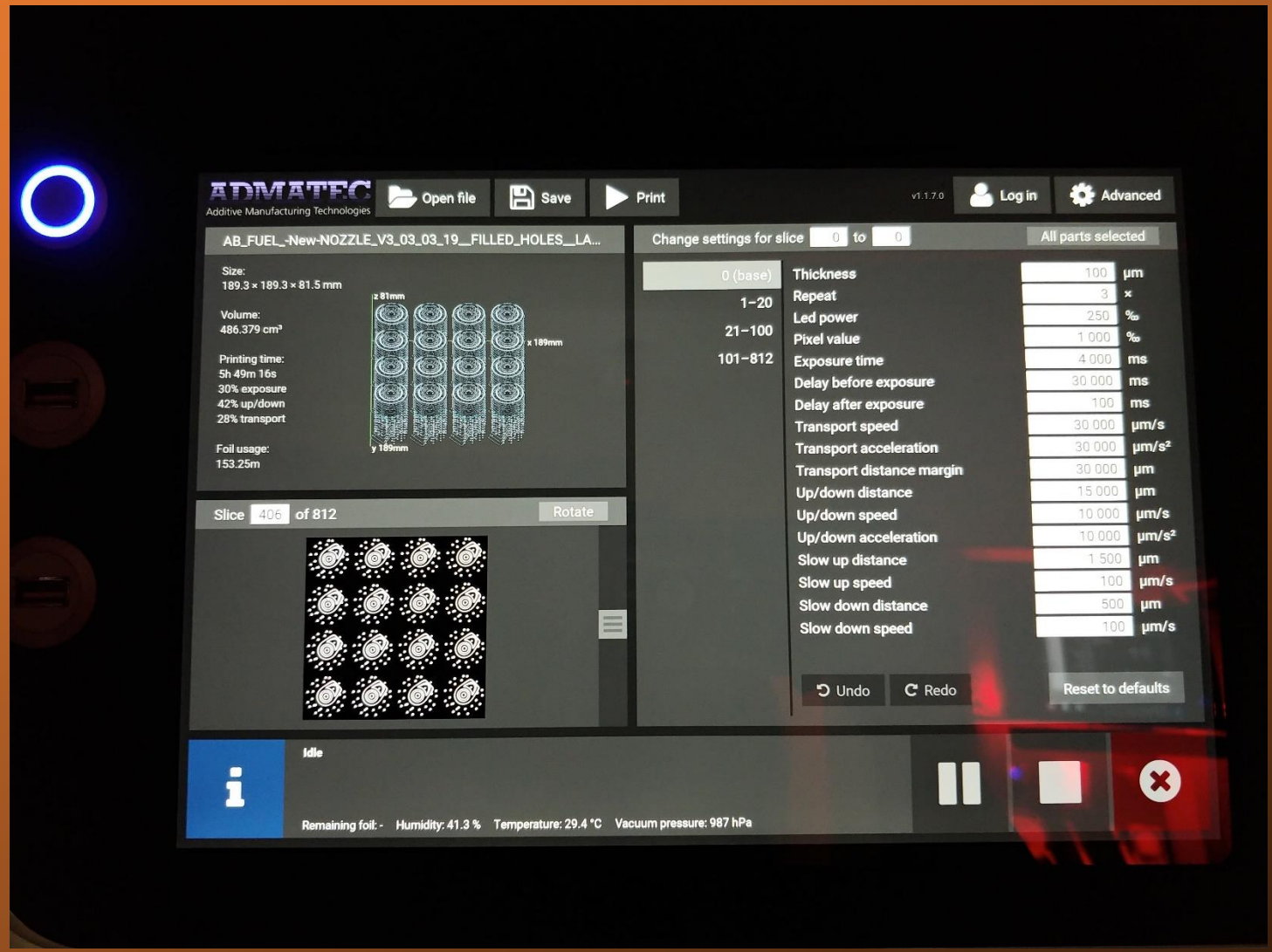
Printed
Investment
Casting
Shell

Build Box: 7.68” X 7.56” X 11.81”

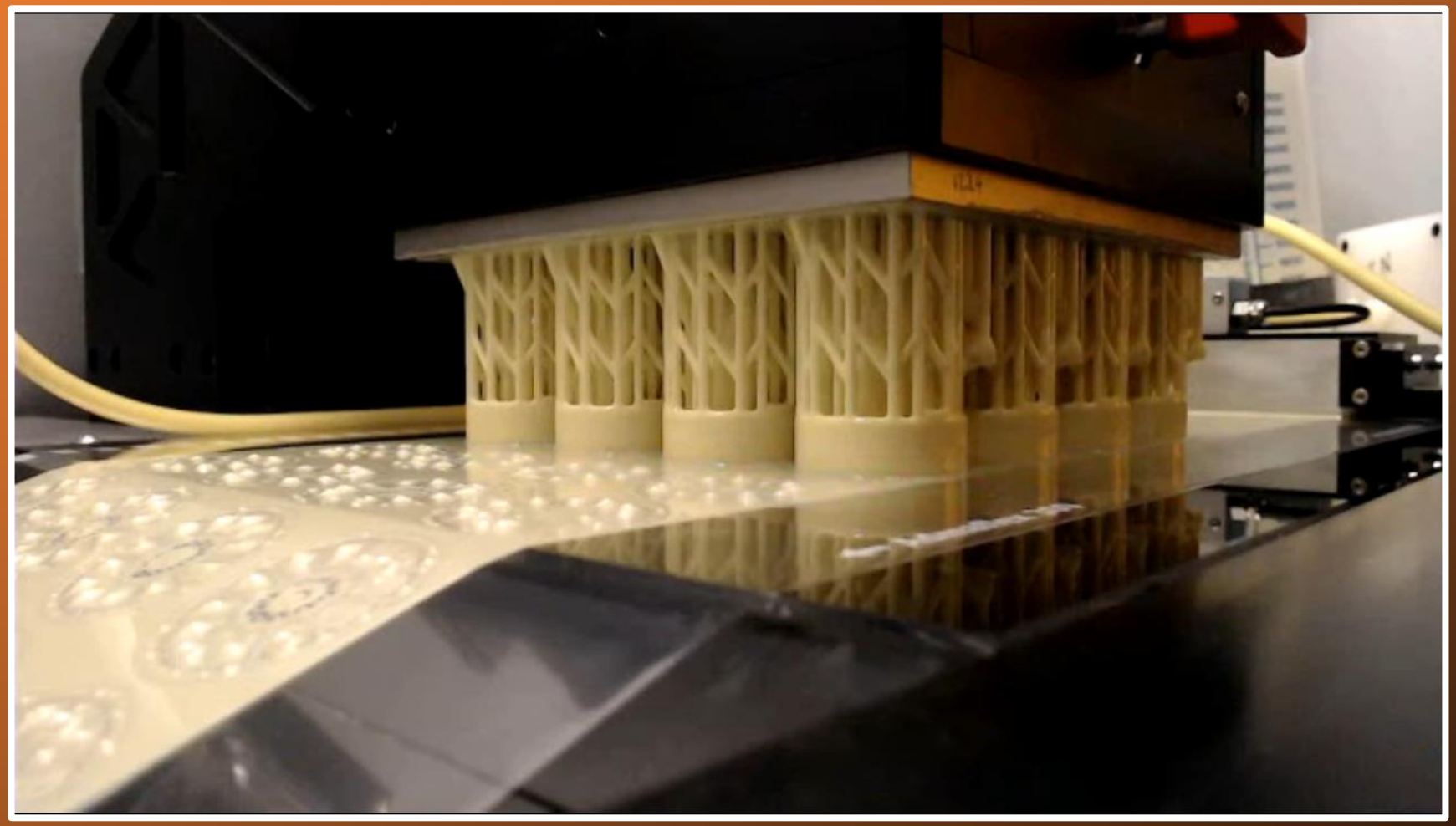
Admaflex 300

Admaflex 300

Build Setup

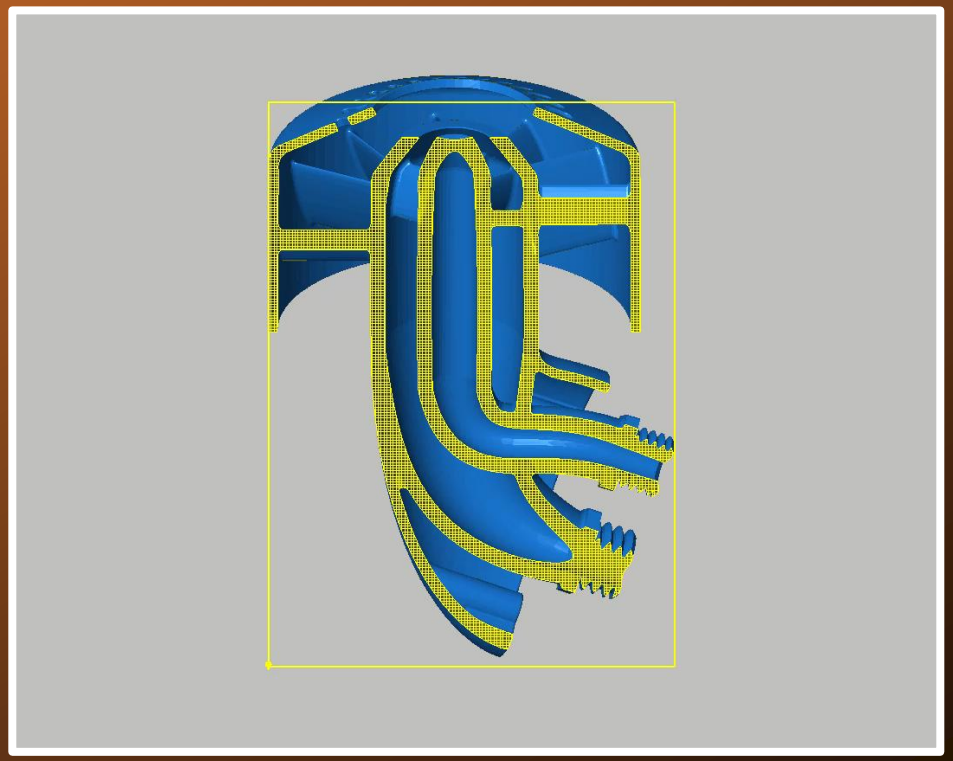

ADMATEC
Additive Manufacturing Technologies
Open file
Save
Print
v1.1.7.0
Log in
Advanced
AB_FUEL_-New-NOZZLE_V3_03_03_19__FILLED_HOLES__LA...
Size:
189.3 × 189.3 × 81.5 mm
Volume:
486.379 cm³
Printing time:
5h 49m 16s
30% exposure
42% up/down
28% transport
Foil usage:
153.25m
z 81mm
x 189mm
y 189mm
Slice 406 of 812
Rotate
Change settings for slice 0 to 0
All parts selected
0 (base)
1–20
21–100
101–812
Thickness 100 µm
Repeat 3 ×
Led power 250 ‰
Pixel value 1 000 ‰
Exposure time 4 000 ms
Delay before exposure 30 000 ms
Delay after exposure 100 ms
Transport speed 30 000 µm/s
Transport acceleration 30 000 µm/s²
Transport distance margin 30 000 µm
Up/down distance 15 000 µm
Up/down speed 10 000 µm/s
Up/down acceleration 10 000 µm/s²
Slow up distance 1 500 µm
Slow up speed 100 µm/s
Slow down distance 500 µm
Slow down speed 100 µm/s
Undo
Redo
Reset to defaults
Idle
Remaining foil: -
Humidity: 41.3 %
Temperature: 29.4 °C
Vacuum pressure: 987 hPa

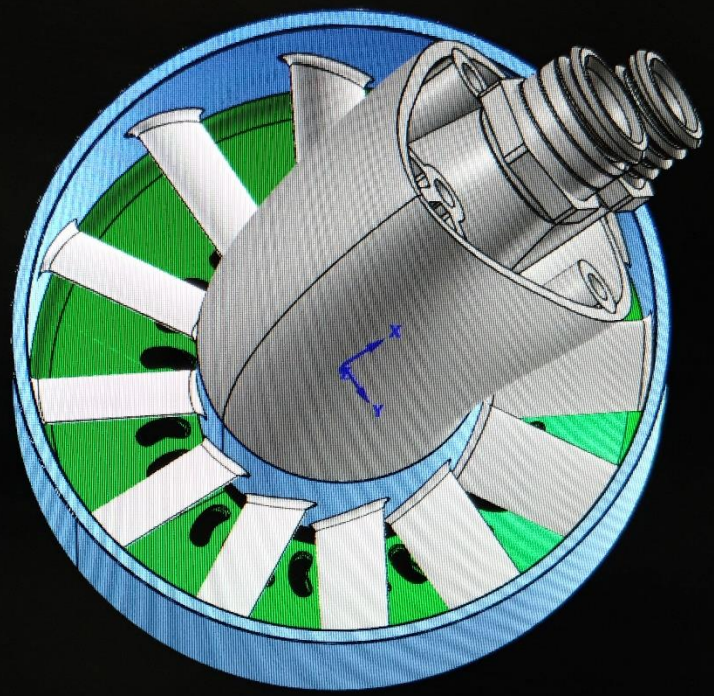
P.I.C.S. Printing



Fuel Nozzle

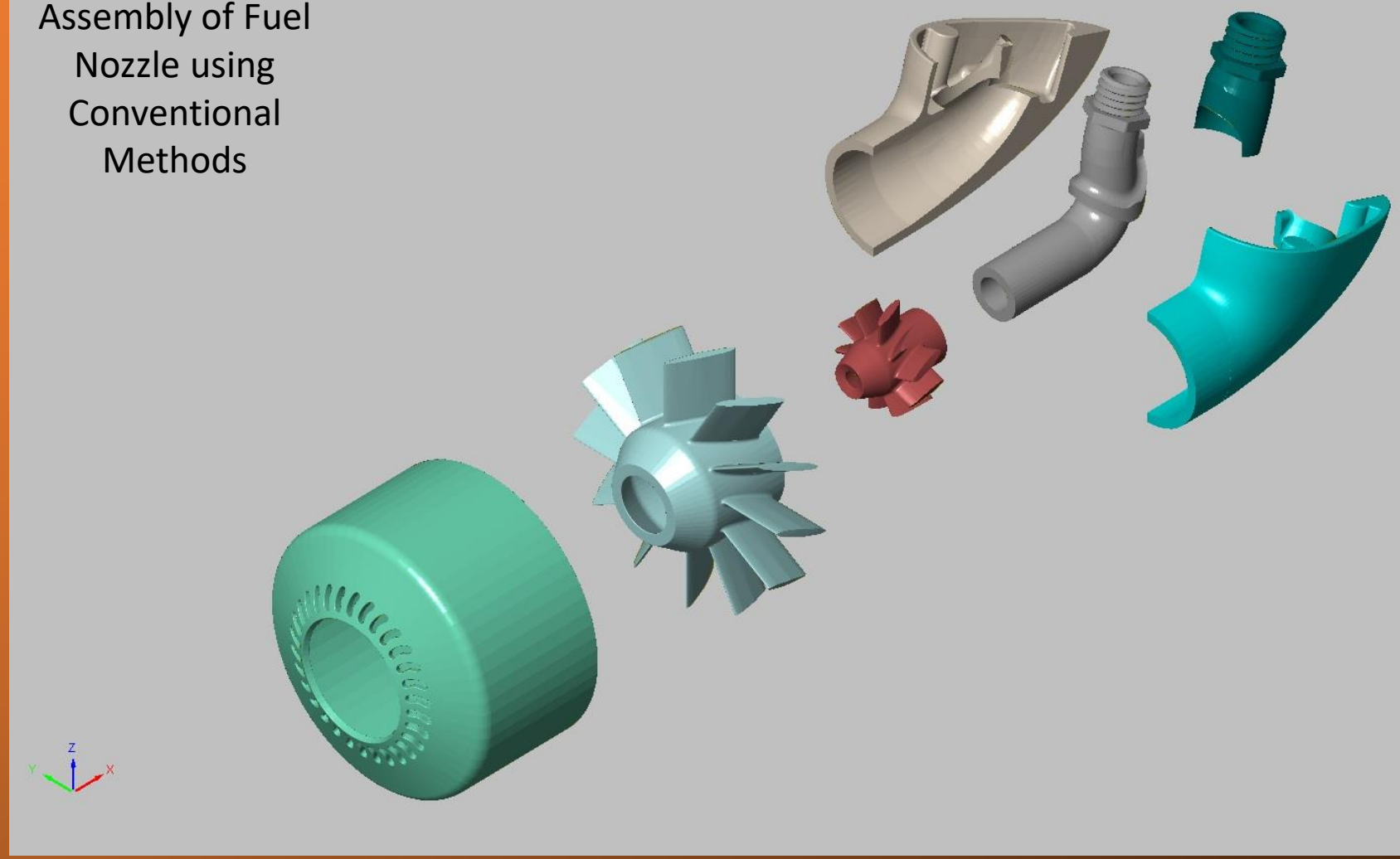
Part CAD

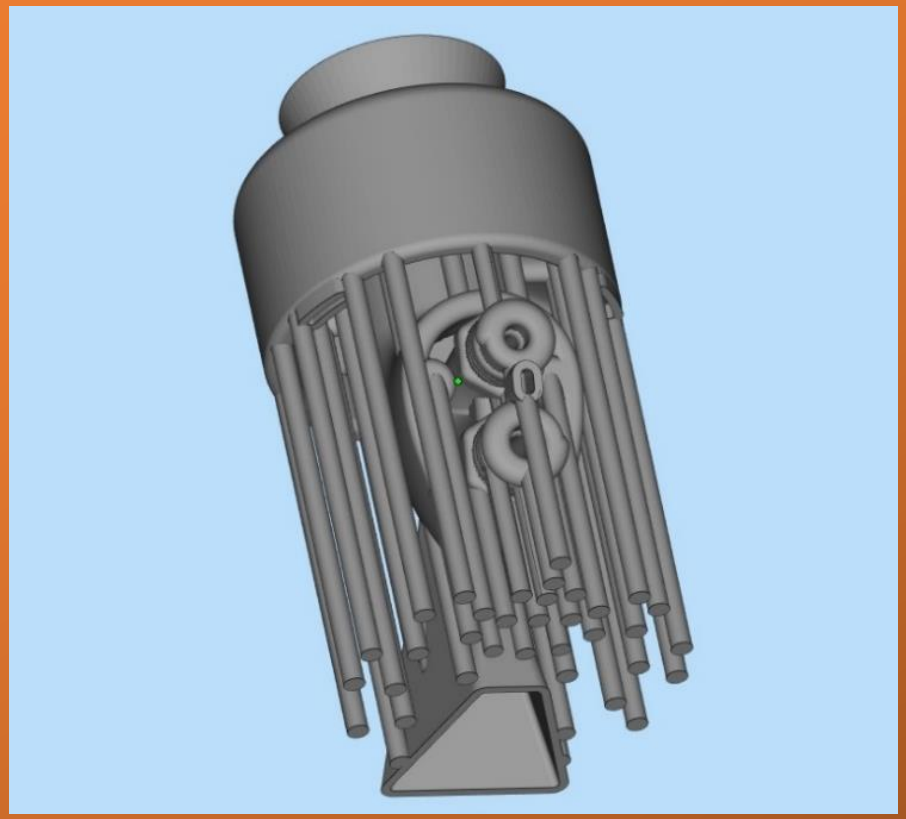




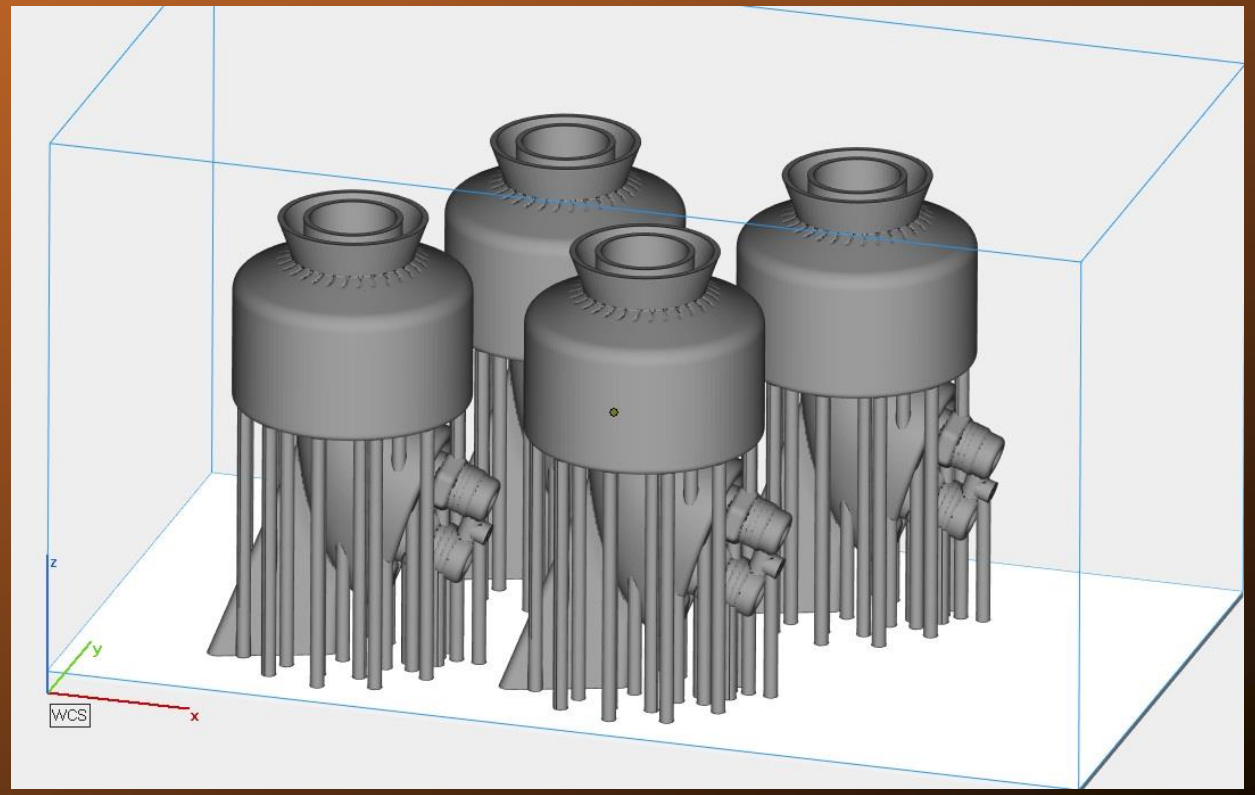
View of interior vanes

Assembly of Fuel Nozzle using Conventional Methods

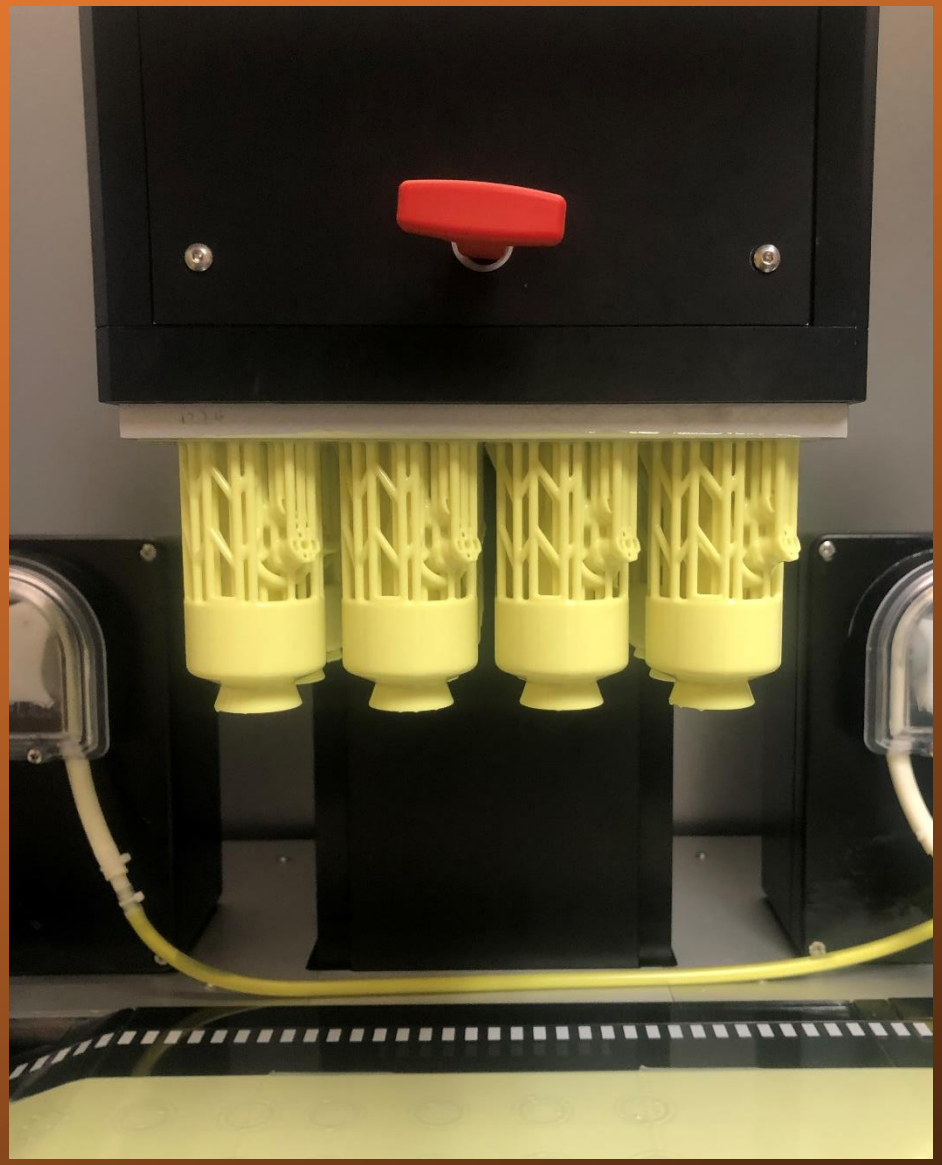




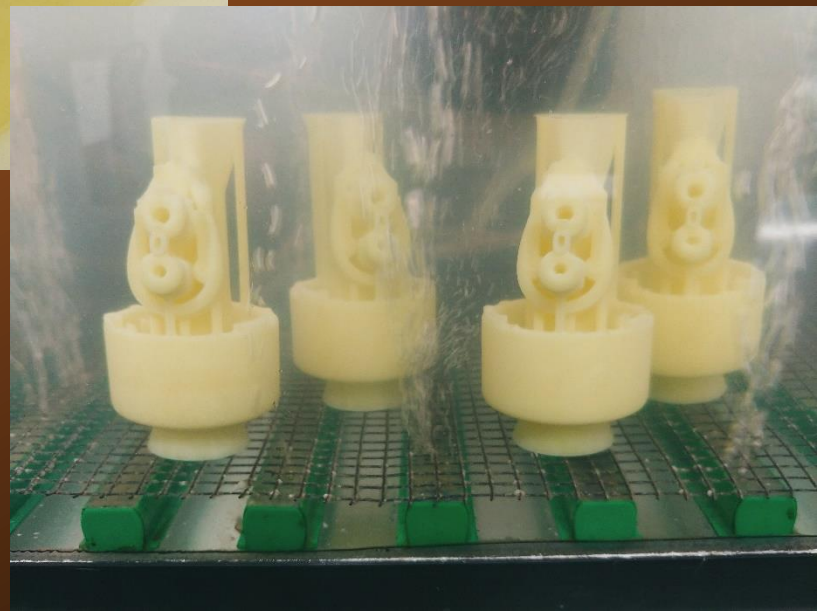
P.I.C.S. Design



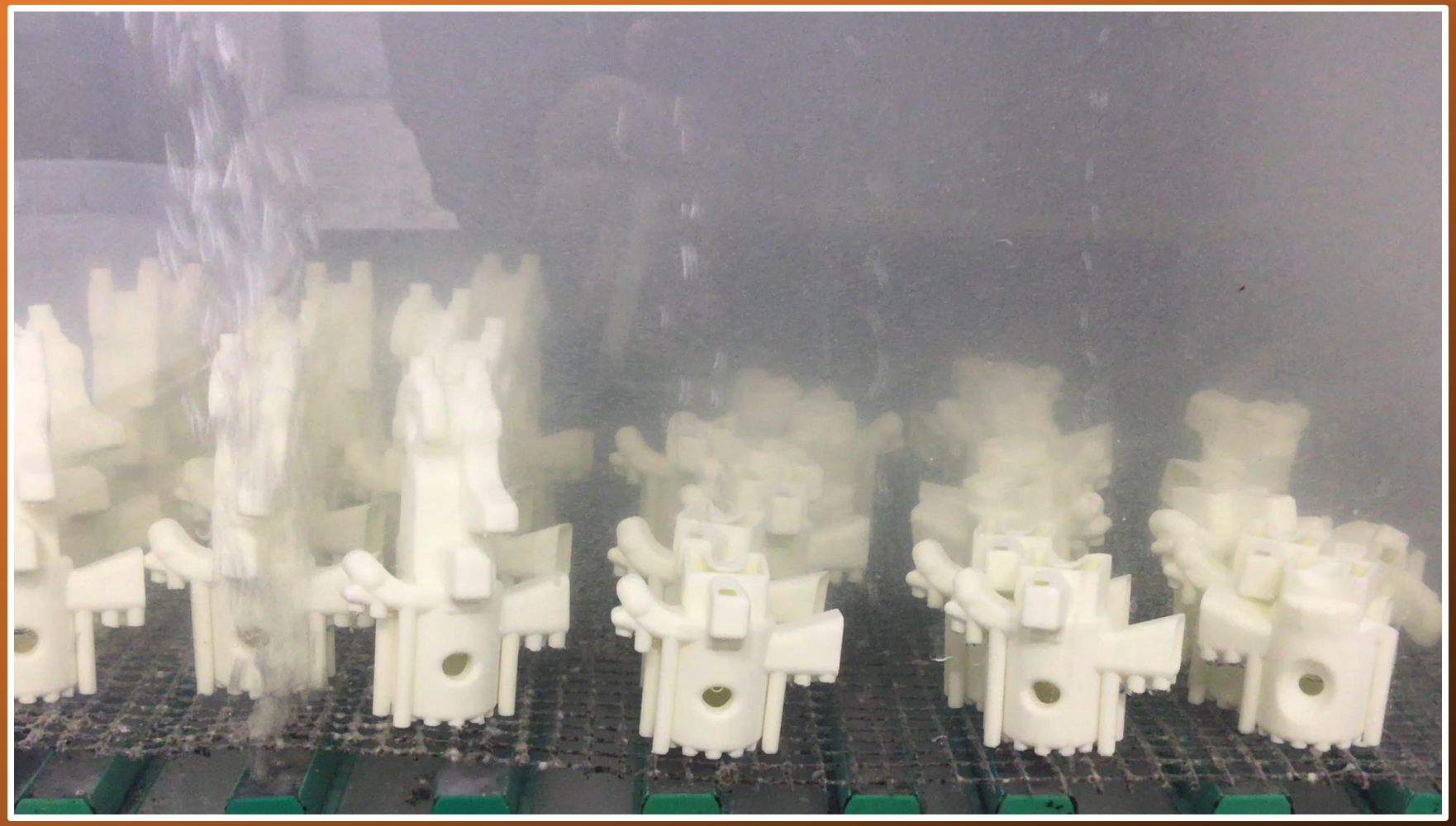
Printed Part



Pattern Cleaning



Fish Tank Debinding



Sintering

Cluster

If the PICS included the sprue, cluster through dewax would not take place.

1st Dip

If dipped conventionally, it would take several days by highly trained personnel to get the inner passageway. That being said, there still would be no way of knowing the integrity of the inner passageway.

2nd Dip

Tie and 3rd Dip

Seal

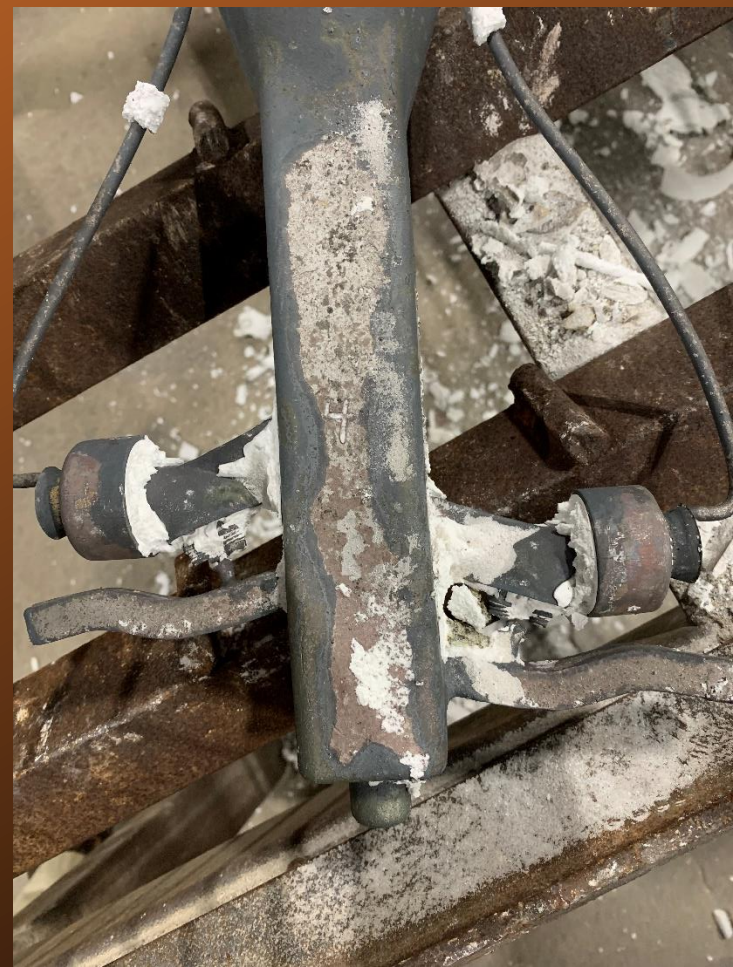
Printed Ceramic Trees take 1 day to dip.

Traditional trees take 6 days.

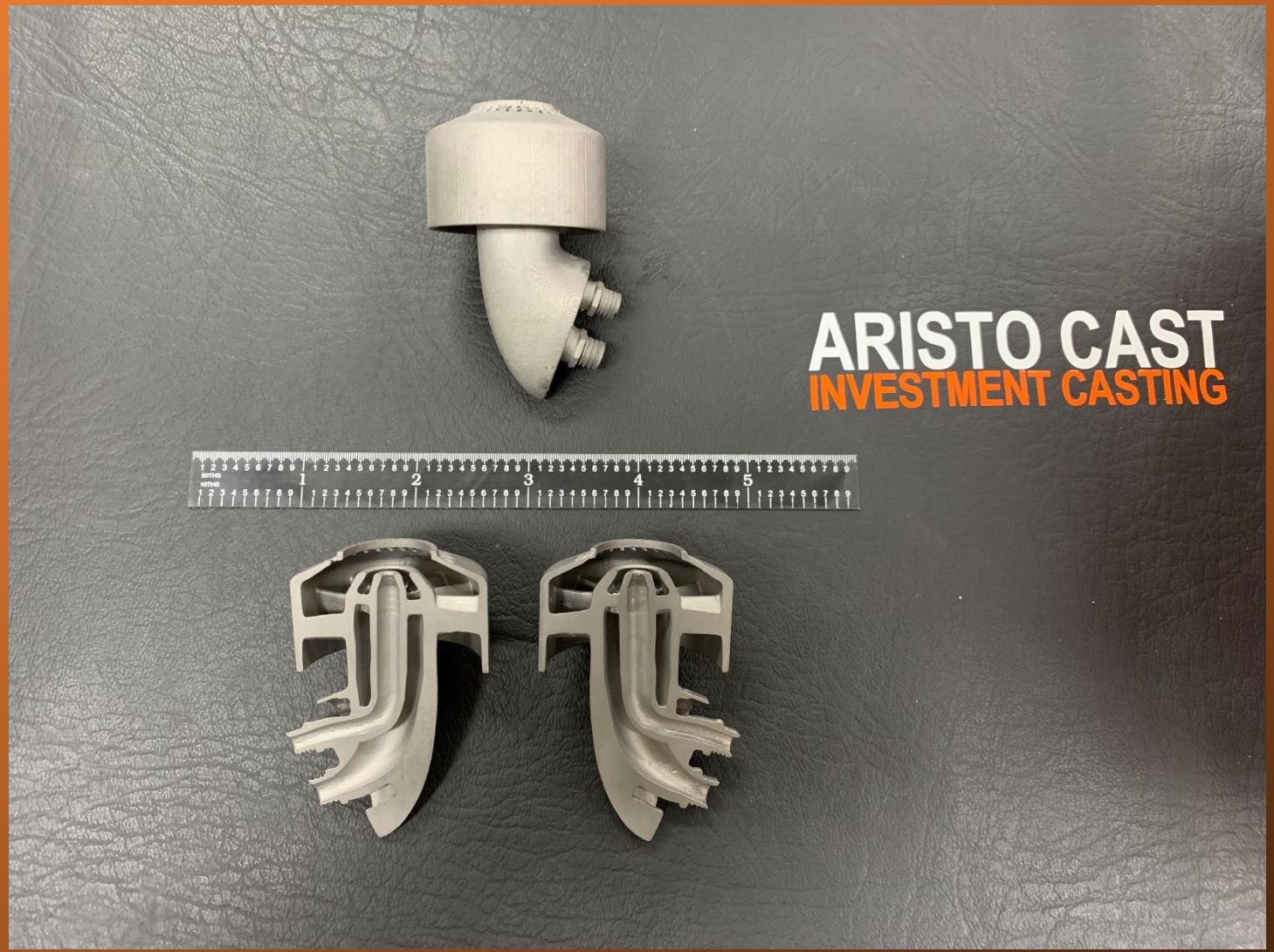
Dewax

Casting Stainless Steel

Knockoff



Casting Results


ARISTO CAST
INVESTMENT CASTING

AFS Casting Competition 2020 Award

Best Prototype or Innovation

Duplex fuel nozzle

Aristo-Cast Inc. (Almont, Michigan)

Material: Stainless steel.
Process: Printed investment shell.
Weight: 115 grams.
Dimensions: 2.5 x 1.5 x 1.5 in.
Application: Aircraft jet engine and land-based turbines.
Customer: Internal design/ proof of concept.

- This fuel nozzle from Aristo-Cast creates a fuel spray pattern for complete combustion.
- Created as a proof of concept, the fuel nozzle was produced using the printed investment casting shell (PICS) process. Similar designs are produced using direct metal laser sintering (DMLS), but the PICS method cuts costs by 50% or more while eliminating barriers to creating a successful investment casting.

OUR GOAL

REVOLUTIONIZE THE CENTURIES OLD INVESTMENT CASTING PROCESS