New Harmony >> New Solutions™

STUDY CASE

Designed an innovative concept of ceramic antenna for space application

With

Context

ANYWAVES has designed an innovative concept of ceramic antenna for space application.

This new concept uses lattice structure in Zirconia to aim the best radiofrequency performances.

This company is looking for a manufacturing process to be able to match the technical and economical requirements.

In this context, 3DCERAM proposes the 3D-AIM service to help ANYWAVES to consider all the process opportunities.

ANYWAVES – an innovative startup for antenna
French Space Agency (CNES) spin-off, ANYWAVES© develops revolutionary antennas for SmallSats.
Based on breakthrough technology and an expert team, ANYWAVES© designs and manufactures a new generation of miniature, high-performance and high-quality antennas for Space applications such as Telecommunications, Navigation, Earth Observation, Atmospheric Input and many others.

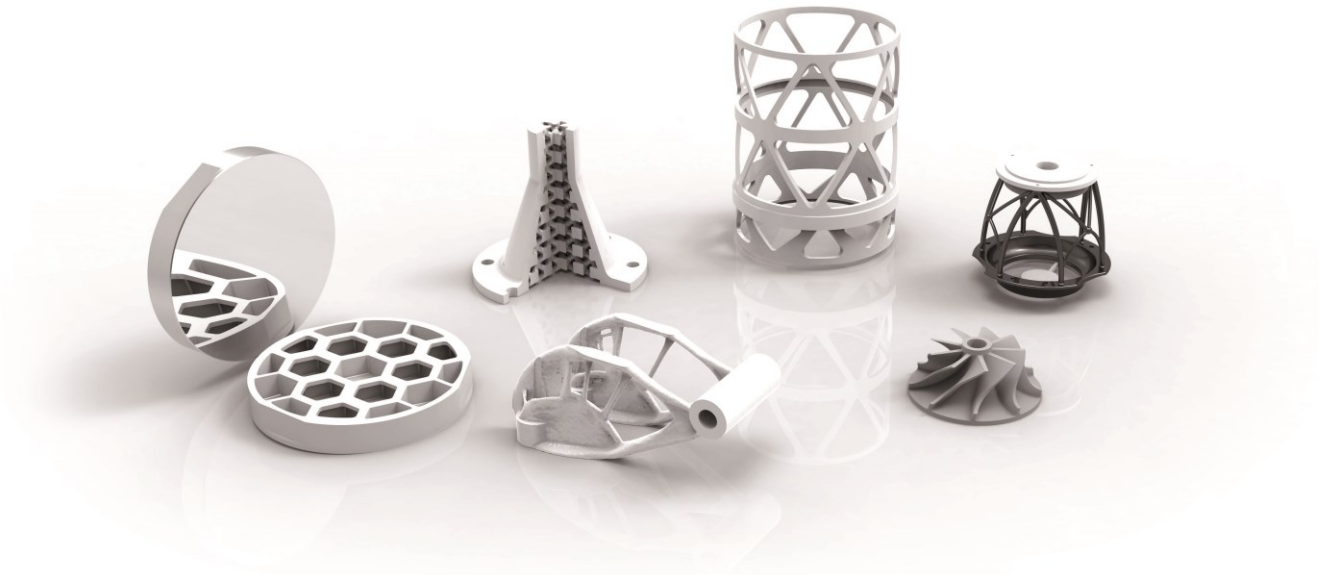
ANYWAVES
CONTROL MATERIAL TO MASTER WAVES

Aerospace companies consider additive manufacturing as a good solution for their future projects

3D-AIM - Consulting services

3D-AIM is a consulting service as well as advices dedicated to **aerospace companies** which consider additive manufacturing as a good solution for their future projects. The idea is **to help the company to develop ceramic** applications from scratch to the part production.

It starts with **a discussion about the specifications such as technical specifications like mechanical preferences but also economic.** This could be a targeted timeframe or targeted cost plan.



3D-AIM, a service dedicated to aerospace projects

3D-AIM - in steps

This approach is flexible as it is adapted to different project phases. It starts from scratch, a blank page to the production of parts. It could also concerned some modifications on an existing ceramic part.

<u>The approach of 3D-AIM consists of three steps:</u>

1) **The first step is a feasibility analysis**. As previously mentionned it starts with a discussion with the customer about his requirements.

2) **Then comes the discussion about all the aspects of the project from its current structures to the part production**. It is very important to gather all this information from the beginning of the project, because it is about to modify the design and the process and all the aspects of the project according to these requirements.

3) **And afterwards comes the risk analysis and a proposal of a de-risking plan.** This is a series of development steps to mitigate the risk of this application in our process.

Overall, 3D-AIM is a global approach which manages the design phases, the production phases and then the technology transfer to the end-user.

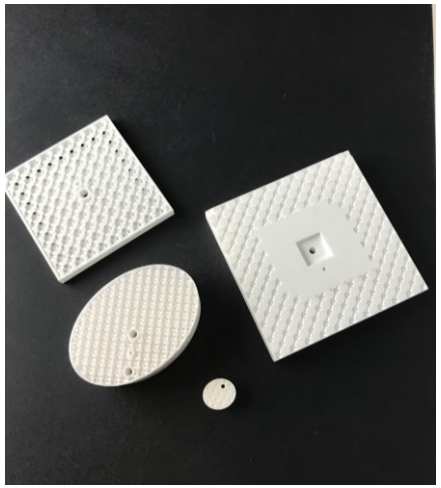
Step1 : Risk analysis approach

A project always starts by a discussion with the customer about **the technical and economical requirements**. Indeed, all the projects facets have to considered to make the better choice of developments.

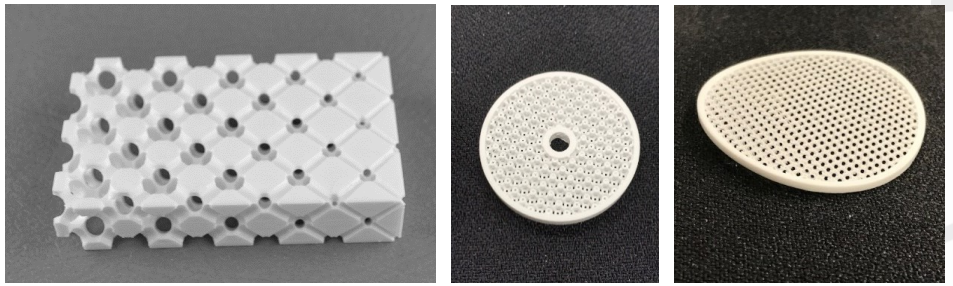
Afterwards, the customer's CAD file is analyzed according to the main process steps:

- **3Dprinting**
- **cleaning process**
- **the debinding and the sintering.**

For each activity**, the risk of failure is evaluated according to the 3DCERAM's expertise and the rules of thumbs**. In the case of ANYWAVES ,we've started by a CAD analysis of several configuration of part with different shapes (picture below).



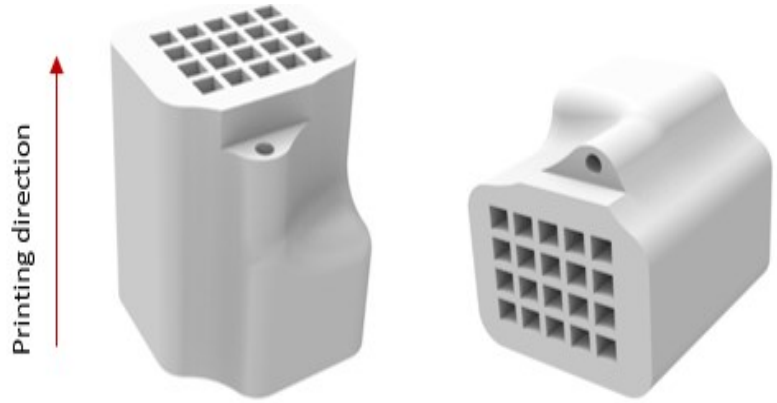
In the case of lattice structures, 3DCERAM has already manufacture several types of design, from the simples one (see picture below, in the left) to the finest and most complex (picture on the right).



The risk analysis is completed by a proposition of benchmark to mitigate the risk. This simple printed benchmark can evaluate the risk and define the best way to produce the final part.

Step 2 : Design to Manufacturing

The second step of the 3D-AIM program consists to modify the CAD file with the customer in order to integrate the results of the first step and the others constraints like the mechanical tolerances or the material quality control.



In this case, we did some CAD proposals to make it more robust. The main objective of this step is to reduce the default (scratch, failure…) which can appear during the process.
We start by the choice of the **part orientation** which depends to the **part tolerances** and the target unit price. An example is presented hereafter on a simple part. In this case, the vertical part will be more precise than the other orientation, but the printing time (and the cost) will be higher.

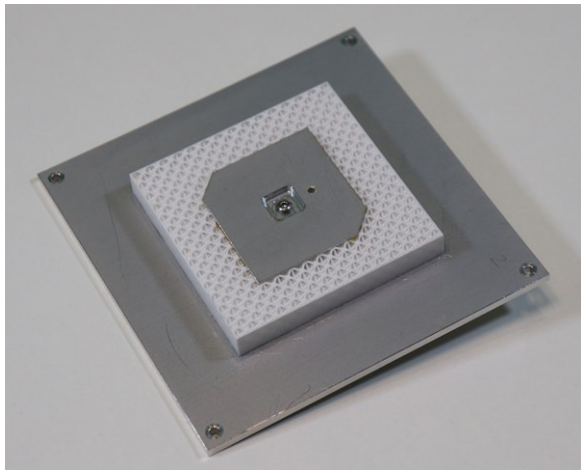
Step 2 : Design to Manufacturing

Afterwards, in the case of complex part, it’s needed to **mesh and fixed correctly the part**. The SLA process needs several correction factors (like the scale factor, see picture below) which warp the meshing and degrade the surface quality.

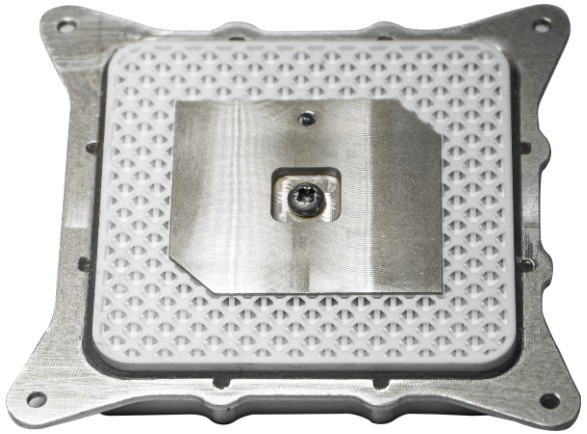
The best CAD file considers also all the small rules like the blend radius on the sharp edge or the maximal shape factor between two connected sections.

Step 2 : Design to Manufacturing

- Some iteration **printing and firing tests** are realized in order to increase the design maturity for the 3Dprinting process.



- At the end of **the Design to Manufacturing step**, the CAD file is ready for production. ANYWAVES is now ready to integrate the ceramic devices into the final product !



Step 3 : Production Step

- The part is now developed, and the maturity is sufficient to produce a series of parts with the quality required. In this step, the customer has two industrials possibilities:

- **1- Invest into a 3Dprinter** – Production of the parts in-house with a technology transfer by 3D-AIM

- **2- Production by 3DCERAM** – Adapted to small series of part or R&D projects

To conclude

With the 3D-AIM service, we were able in 18 months to bring the company Anywaves from scratch to the in-house parts' production.

Today ANYWAVES is positioned as one of the most innovative French newspace companies.

ANYWAVES

CONTROL MATERIAL TO MASTER WAVES

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3DCERAM