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Tech Sheet

Generative Design with NASA

NASA embraces generative design to significantly accelerate their product development process. By adding design parameters to generative design software, NASA engineers can use artificial intelligence (AI) to drastically reduce development time for functional parts.

The generative design process is faster, optimizing parts for mass and stiffness, and ensures manufacturability.

	Design Time	Design Iterations
Human Engineers	2 days	4
Generative Design/AI	1 hour	31

Spotlight: PowerSource Global Summit

NASA engineers developed an Evolved Structure at the Power Source Global Summit where they asked attendees to develop requirements for a hypothetical science mission on the moon as part of the Artemis program.

Scenario
During the Artemis mission, astronauts will capture volatile compounds released after sunrise on the surface of the moon. During that time, the temperature increases dramatically from -315 F to -55 F (-193 C to -48 C). Conference attendees used generative design strategies to create an apparatus that would effectively hold the sample collection containers.

Key Design Parameters

Structure cannot weigh more than 68 pounds
Aluminum 6061 has an outstanding strength-to-weight ratio allowing for the apparatus to meet requirements while weighing less than four pounds.

Stackable/Modular
Space travel is expensive, so size was reduced via stacking.

Can be placed on a sloped surface
Create feet for myriad ground conditions.

Quickly machinable
Breaks in the circular border allow for 2-axis CNC machining in just 19 hours.

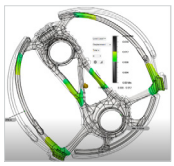
Part Delivered in 36 Hours

Monday
1:00-5:00pm Generative design computations
5:00-8:30pm Design modified based on DFM feedback to accomplish quick-turn milling
8:45–9:20pm CAD file uploaded to Protolabs digital thread
9:34pm Block loaded into milling machine

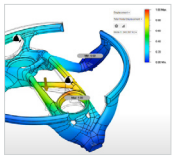
Tuesday
4:00pm Part is complete after nearly 19 hours of milling time
4:31pm Part leaves Protolabs facility in Brooklyn Park, Minn.

Wednesday
8:00am Part arrives in Orlando, Fla. before the doors open at the PowerSource Global Summit

No larger than a shoebox
X: 9.75 in. (247.64mm)
Y: 9.88 in. (250.98mm)
Z: 2.88 in. (73.17mm)



Design considers wide temperature range
Thermal stress analysis confirmed feet would likely bind when cooled, providing for easier movement.



Durable
Base modal frequency over 100Hz provides better survivability during launch conditions.

Visit protolabs.com to learn more about how NASA engineers are using generative design.