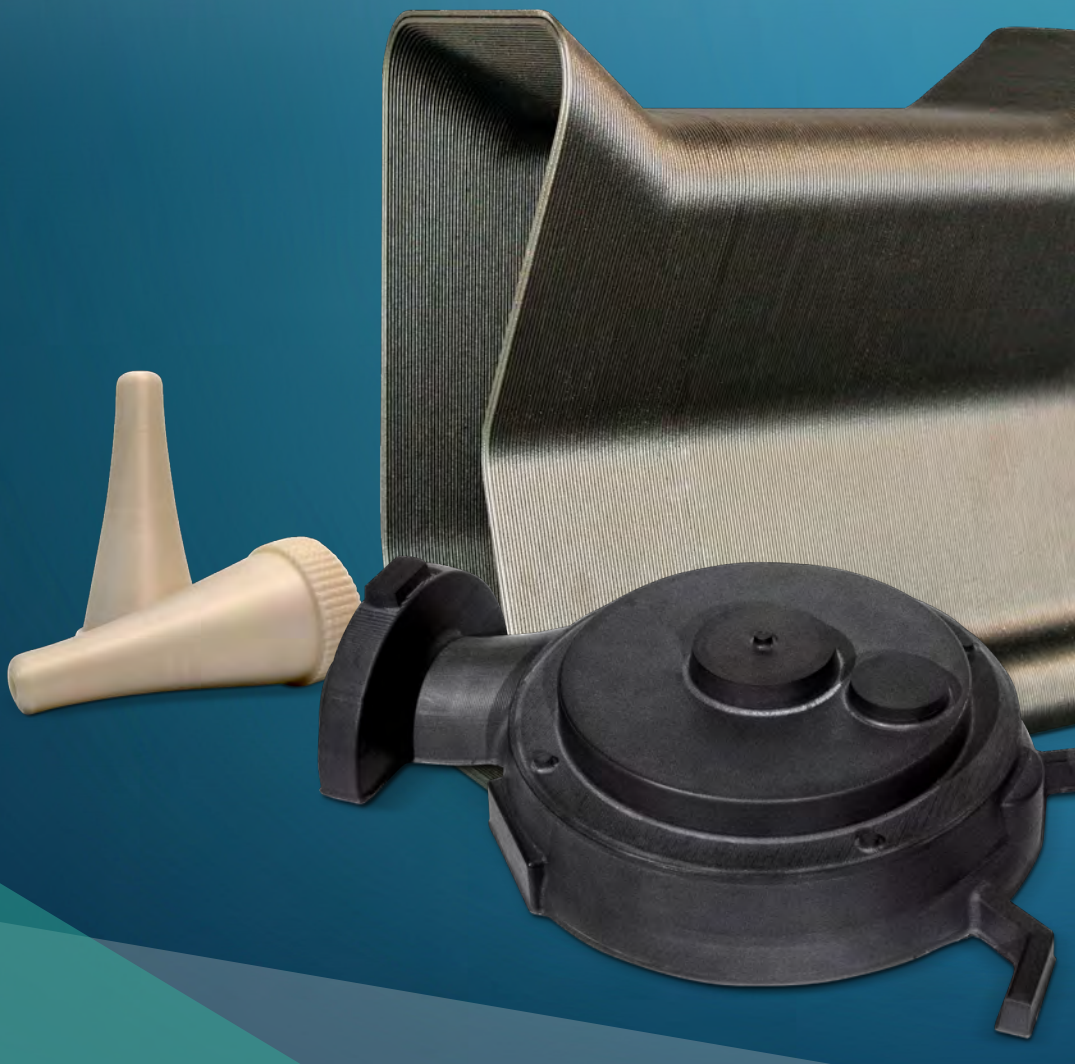
LARGE-FORMAT BUYER'S GUIDE

Top 10 critical points for purchasing large-part 3D printers for Aerospace



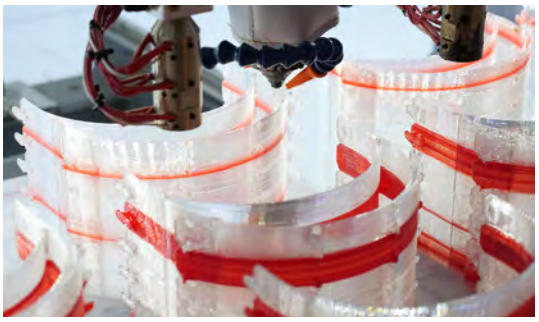
3D SYSTEMS
Additive Manufacturing Solutions

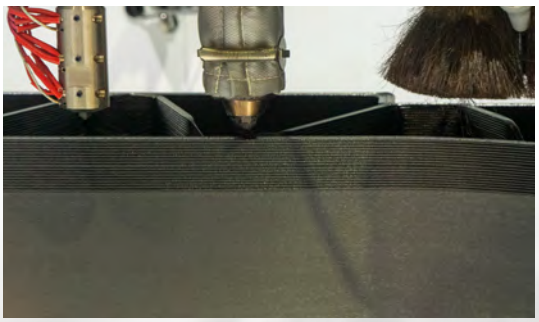
Large-format 3D printing

Pellet extrusion 3D printers offer significant performance advantages for aerospace manufacturers compared to conventional production techniques

As 3D printing advances, aerospace manufacturers have become increasingly reliant on the technology for disparate production processes. In large-part production, for example, aerospace manufacturers can now print complex parts using simple designs that begin with minimal components, reducing the risk of part failure.

While 3D printing with plastic filaments offers a reliable method for small-part production, it represents a considerable cost for large-part production. As a result, major companies in industries ranging from aerospace and automotive to foundry and healthcare have adopted pellet extrusion 3D printing technology, which offers lower total cost for both ownership and part production.





ADVANTAGES OF PELLET EXTRUSION

Pellet extrusion 3D printers use lower-cost pellet feedstocks that can save companies 5 – 10x on raw material costs. Some 3D printer models offer dual pellet extruders, or a hybrid dual pellet-filament extrusion head setup combined with an optional three-axis spindle. Such a setup offers a unique combination of additive and subtractive capabilities within a single platform that performs the work of multiple machines.

Beyond material cost savings, pellet extrusion 3D printers offer significant speed advantages with the ability to print part sizes up to 50” x 50” x 72” using high performance and high temperature materials at speeds up to 30,000 mm/min. In addition, certain 3D printers are compatible with a wide range of material options and various nozzle sizes and toolheads that allow aerospace manufacturers to optimize designs and produce higher quality parts than they could using conventional production techniques.

Business considerations

Top 10 critical points for purchasing large part 3D printers for aerospace:

Production-grade 3D printers with industrial control systems minimize machine downtime, speed up production, and reduce costs, but choosing the right solution can be daunting. The following guide presents 10 factors to consider when choosing the right solution for large-format part production.

1. FIND A SOLUTION PROVIDER, NOT JUST AN EQUIPMENT SUPPLIER

Does your 3D printing solution provider offer end-to-end support that gives you a complete solution and accelerates adoption of 3D printing?

Aerospace manufacturers that simply purchase a 3D printer from an equipment supplier will need to fill gaps throughout the process, whereas a solution provider offers end-to-end support. Up-front, this service should include guidance with part design and selection of appropriate materials and equipment, followed by printer operating parameters setup.

Tailored solutions are necessary in many cases, so a solution provider should assist with selecting the right hardware options, application development, research and development, and material testing. Additionally, a reliable 3D printer solution provider should offer in-house equipment and capabilities that may include the integration workflow tools and post-processing assistance.

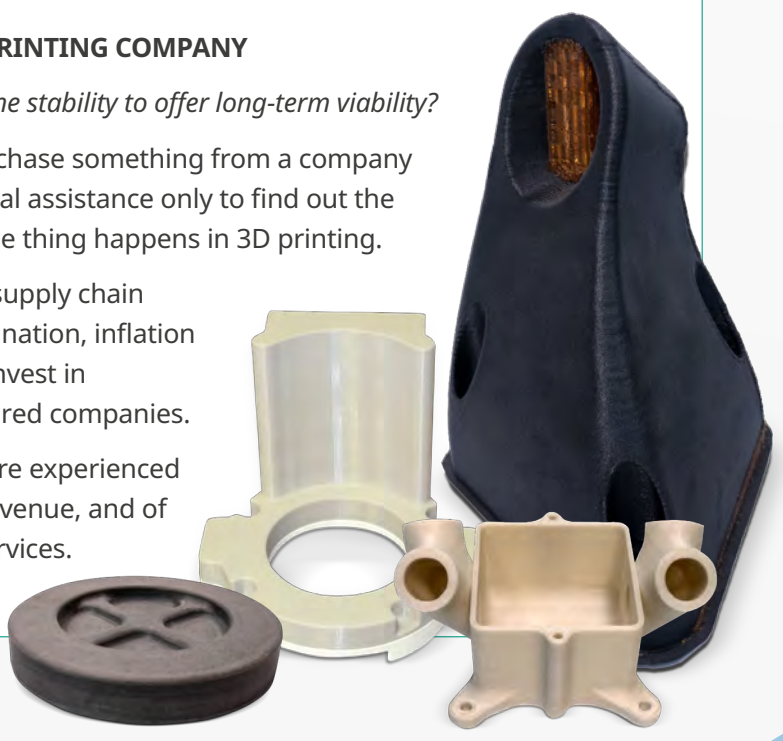
2. PUT YOUR TRUST IN AN ESTABLISHED 3D PRINTING COMPANY

Does your 3D printing solution provider have the stability to offer long-term viability?

It's happened to many of us before: You purchase something from a company and need a part replacement or some general assistance only to find out the company has gone out of business. The same thing happens in 3D printing.

In today's turbulent economic times—from supply chain disruptions and COVID-19 to the Great Resignation, inflation and recessions—manufacturers looking to invest in 3D printing should identify established, tenured companies.

A reliable 3D printing company should feature experienced employees, trusted leadership, consistent revenue, and of course, a broad portfolio of products and services.



3. FOCUS ON MULTIFUNCTIONAL MACHINES

Does your 3D printing solution provider specialize in pellet extrusion and filament extrusion?

Combining pellet and filament extrusion technologies in one system brings manufacturers the flexibility to choose the right extrusion technique for a particular application. For example, for large parts that must be printed quickly, pellet extrusion works best. But for parts that require high surface resolution and fine details, filament extrusion is preferred. Additionally, hybrid printing enables printing with dual materials, which may include soluble support material and high-performance model material.

PELLET EXTRUSION

Large parts that must be printed quickly

FILAMENT EXTRUSION

Parts that require high surface resolution and fine details

HYBRID PRINTING

Parts with dual materials, which may include soluble support material and high-performance model material

4. CONSIDER ADDITIVE AND SUBTRACTIVE NEEDS

Does your 3D printing solution provider offer hybrid toolhead configurations that enable additive and subtractive capabilities in a single machine?

Identifying a 3D printer capable of additive and subtractive capabilities significantly lowers capital expenses and operating costs and eliminates/reduces the physical space required for a second machine. Aerospace manufacturers should seek a solutions provider that offers a hybrid machine capable of fast printing with pellet extrusion and equipped with a milling toolhead to quickly smooth the part either during or after the printing process, while keeping the part on the print bed. Such a system delivers reduced cycle times, smooth and accurate parts, and the capability to manufacture end-use parts, patterns, molds, tools, jigs, and fixtures fast and cost-effectively on a single machine.

5. FACTOR IN TOOLHEAD AND NOZZLE FLEXIBILITY

Does your 3D printing solution provider offer flexible toolhead and nozzle configurations?

Similarly, aerospace manufacturers should ensure that the 3D printer they purchase offers multiple toolhead configurations, including pellet extrusion and dual pellet extrusion heads for larger support structures, along with hybrid pellet and filament extrusion heads for smaller support structures.

A 3D printer should also provide a range of pellet extruder nozzle sizes. For example, a flexible 3D printer should offer pellet nozzle diameters from 0.6 to 9 mm and pellet extruder throughput from 1 to 30 pounds per hour. In addition, a 3D printer should support different ranges for filament nozzles. This might mean a nozzle diameter range of 0.4 to 1.2 mm, filament layer heights of 0.15 to 1 mm, and filament extruder throughput of throughput that can reach a maximum of 2 pounds per hour.

6. PRIORITIZE A 24/7 GLOBAL SUPPORT NETWORK

Does your 3D printing solution provider offer a 24/7 global support network and compliance with relevant standards?

Aerospace manufacturers that invest in a 3D printer should expect around-the-clock support and expertise. This should include not only 3D printer support but software and overall application support as well. Beyond that, the 3D printing solution provider must also comply with global and local standards—regardless of the region in which the machine is deployed—while offering this comprehensive support.

7. MENTION MOTION CONTROL

Does your 3D printing solution provider's equipment feature an industrial control system?

When seeking a 3D printer, ask the solution provider about a control system. 3D printing in a production environment must meet time and cost saving requirements, so 3D printing companies must identify a reliable system to avoid downtime. Ideally, the 3D printer will run on a servo-controlled open architecture CNC control system.

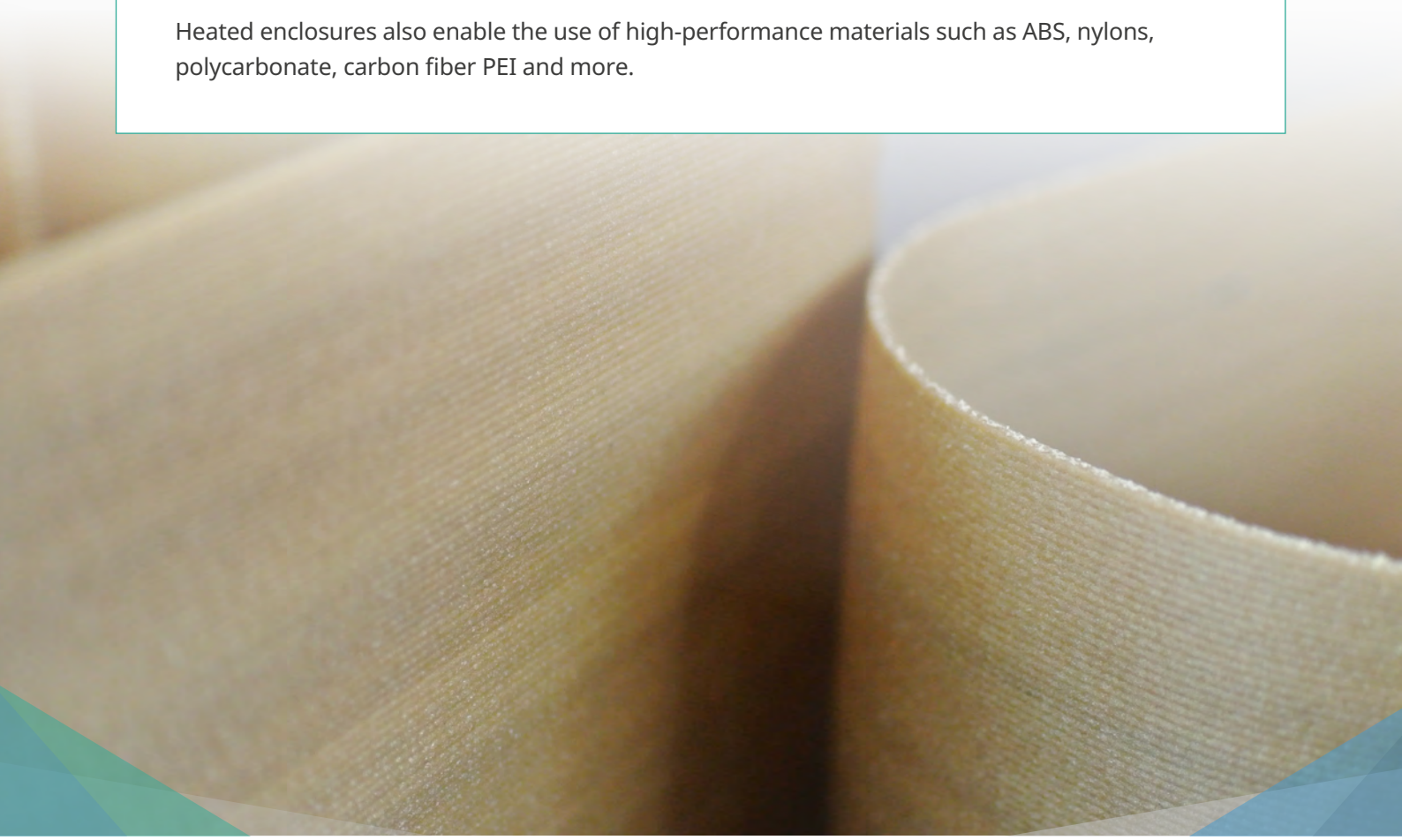
When running on CNC controllers, 3D printers offer increased speeds and the 24/7 reliability that aerospace manufacturers require. Additionally, these control systems are often deployed in other parts of the production process, meaning employees will already be familiar with operating them.

8. ASK ABOUT HEATED ENCLOSURES

Does your 3D printing solution provider factor in heated enclosures on its large-part printing equipment?

Printing large parts requires a heated print chamber to maintain a part's dimensional stability. When considering a 3D printer for large-part production, be sure to ask the solution provider whether the system offers an actively heated industrial enclosure on the machine. A heated enclosure prevents part warpage while maintaining the polymers at a consistent temperature throughout the entire 3D printing process.

Heated enclosures also enable the use of high-performance materials such as ABS, nylons, polycarbonate, carbon fiber PEI and more.



9. MAKE MATERIALS A PRIORITY

Does your 3D printing solution provider's equipment provide a wide range of material options to ensure your success?

Different 3D printing applications require various material types for production. A reliable 3D printing solution provider should offer several options, while also providing the full material characteristics and processing parameters.

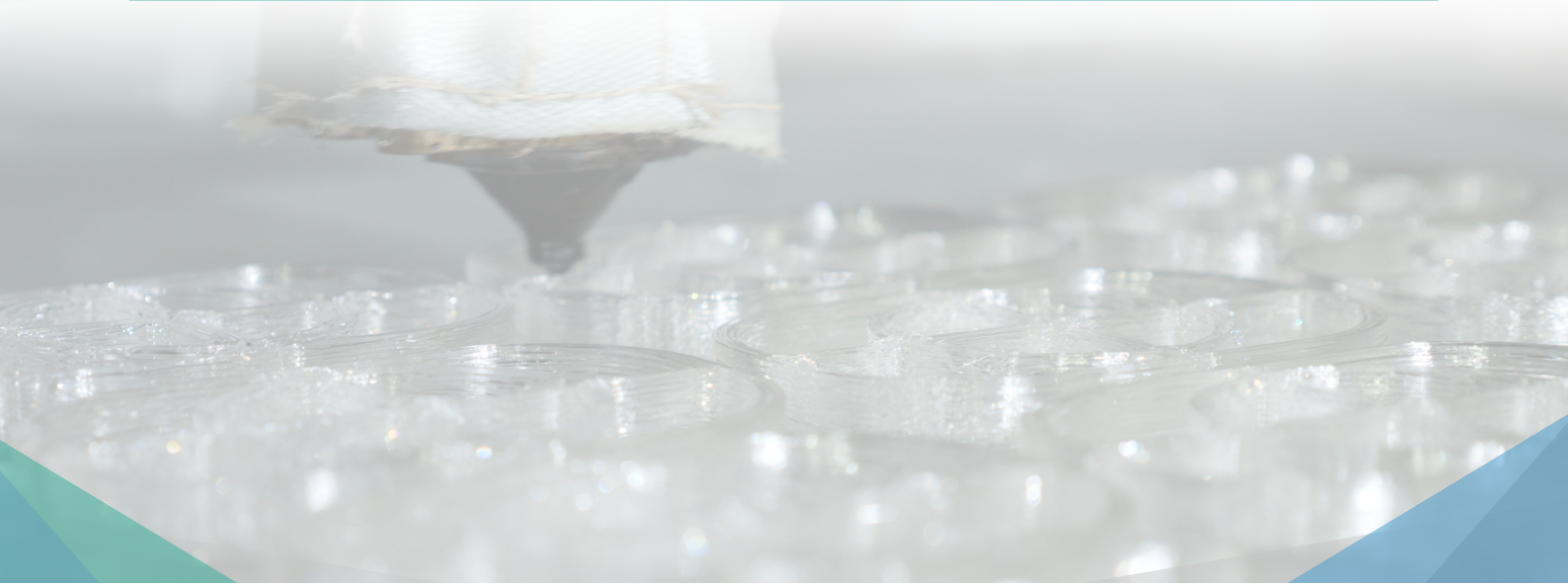
Additionally, companies should ask a 3D printing solution provider if the machine uses open market feedstocks, as doing so will allow the aerospace manufacturer to use any materials they choose for their application. Ideally, the 3D printing solution provider will guide the aerospace manufacturer in the right direction when it comes to identifying, sourcing and implementing the right material for their applications, however.

10. ADDRESS NECESSARY ADD-ONS

Does your 3D printing solution provider integrate accessories such as feedstock drying systems, filtration units, and thermal cameras?

Ensuring the safe and efficient operation of a 3D printer necessitates some additional accessories beyond the standard machine. This should include a pellet dryer, as large-part printing requires clean and dry feedstocks with no contamination. An integrated drying system helps remove moisture contamination, which in turn improves overall part quality. Filtration units are also required, as vapors and emissions must be removed for safety and to address facility concerns.

In addition, thermal imaging cameras provide an added layer of protection with regard to process control. By installing thermal imaging cameras, manufacturers can ensure consistent material deposition and avoid the significant costs of identifying a failure during large-part printing halfway through the process.



Transforming aerospace additive manufacturing with up to 10X faster print speed and 10X savings on materials

Our proven pellet-extrusion additive manufacturing (AM) technology reduces per part costs and delivers higher part performance with lights-out reliability. EXT Titan Pellet systems are relied on by aerospace companies for applications from tooling to end-use part production.

REDUCED PART COST

Up to 10X faster print speeds and 10X reduction in raw material costs compared to filament 3D printing, drastically lowering per part cost vs. FDM/FFF printers.

LIGHTS-OUT RELIABILITY

EXT Titan Pellet systems are built for lights-out manufacturing on the production floor with industrial CNC motion control systems, servos on all axes and ultra-reliable extruders.

HIGHER PART PERFORMANCE

With a wide range of pellet feedstocks available, including high-temperature and fiber-reinforced materials, EXT Titan Pellet systems enable customers to use the right material for their industrial production applications.

MORE THAN JUST MACHINES

Our experts can help you with material validation, process refinement, toolpath development, post-processing, and more. Our global service team has you covered to maximize machine uptime when it's time for maintenance.

Why print with pellets? Speed, low cost, and a huge selection of industrial materials.

As the raw form of most thermoplastics, pellets are the lowest cost feedstock available for additive manufacturing, and they're available in hundreds of formulations.

From high-strength fiber-reinforced industrial plastics to highly flexible elastomers, pellet extrusion offers a broad range of material choices. Our open materials architecture enables customers to choose between buying materials on the open market or buying certified, production-ready pellets direct from 3D Systems. Here is a sample of materials compatible with EXT Titan Pellet 3D Printers:

Flexible Materials (as flexible as Shore A 26)

- TPU
- TPE
- PEBA
- TPC

Standard Materials

- PLA
- ABS
- PETG
- PP
- ASA

High Performance/Filled Materials

- PC 20% CF & GF
- Nylons up to 50% CF
- PEI 20% CF & GF
- PPS
- PPSU
- PEKK 30% CF & GF

In-situ Compounding

- Color blending
- Material blending
- Instantaneous or gradient transitions

Engineered for repeatable results and configured to meet the unique demands of your aerospace AM applications.

In addition to generous build volumes, EXT Titan Pellet 3D printers are packed with features and configurable options that make them stand out against other "big" printers.

Standard features include welded steel frames, active bed and chamber heating, industrial CNC motion controllers, and servo motors on all axes. All systems come standard with a single high-speed, precision pellet extruder and some models may be configured with up to three toolheads including a second pellet extruder, filament extruders, and a milling spindle. Additional options include pellet dryers, fume extraction/filtration, and more.

Platform Common Specifications

Max. Temperatures	Pellet Extruder: 400°C Filament Extruder: 400°C Print Bed: 140°C Build Chamber: 80°C
Print Speeds	Up to .5m/sec
Rapid Travel Speeds	Up to 1m/sec

Extrusion Capabilities	
Pellet Nozzle Diameters	0.6–9.0 mm
Pellet Extruder Throughput	1–30** lbs. per hr
Filament Nozzle Diameters	0.4–1.2 mm
Filament Extruder Throughput	< 1–2 lbs. per hr

**max flow rate with 9 mm nozzle

Spindle Features	
Speed	18,000 RPM (1.5HP)
Tool Size	Up to 1/4" diameter, 4" length
Tool Calibration	3-axis sensor configuration

EXT 800 Titan Pellet

Build Volume	800mm x 600mm x 800mm (31.5" x 23.6" x 31.5")
Toolhead Options	Single Pellet Only
Power Input	208V 3 Phase, 60 amp
Machine Weight	1814 kg (4000 lb)
Dimensions	2.13m x 1.4m x 1.92m (7' x 4.6' x 6.3')

EXT 1070 Titan Pellet / LT

Build & Cut Volume	1070mm x 1070mm x 1118mm (42" x 42" x 44") 1041mm x 990mm x 990mm (41" x 39" x 39")
LT Model Build Volume	1070mm x 1070mm x 1219mm (42" x 42" x 48")
Toolhead Options	Single or Dual Pellet , + Single or Dual Filament , + Spindle up to 3 heads total
LT Model Toolhead Options	Single Pellet , + Single or Dual Filament
Power Input	208V 3 Phase, 60 amp
Machine Weight	2041 kg (4500 lb)
Dimensions	2.43m x 2.13m x 2.62m (8' x 7' x 8.6')

EXT 1270 Titan Pellet

Build & Cut Volume	1270mm x 1270mm x 1829mm (50" x 50" x 72")
Toolhead Options	Single or Dual Pellet , + Single or Dual Filament , + Spindle up to 3 heads total
Power Input	208V 3 Phase, 100 amp
Machine Weight	2721 kg (6000 lb)
Dimensions	3.35m x 3.05m x 3.05m (11' x 10' x 10')

Strengthen the future of your aerospace AM business

Highly productive and cost-saving technologies like pellet extrusion are enabling companies to remain competitive and flexible.

Knowing where to start when it comes to identifying the right system can be a challenge. Engineers from our Application Innovation Group will partner with you to determine the right AM solution for your business today.

LEARN MORE

3D Systems Corporation
333 Three D Systems Circle
Rock Hill, SC 29730
www.3dsystems.com

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