Appendices

Appendix A: Glossary of terms

The following are key terms used in this report.

additive fabrication	Same as additive manufacturing.
additive layer manufacturing	Same as additive manufacturing.
additive manufacturing*	Process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies; synonyms include additive fabrication, additive processes, additive techniques, additive layer manufacturing, layer manufacturing, and freeform fabrication.
Additive Manufacturing File	From ASTM F2915 "Specification for Additive Manufacturing File (AMF) Format," AMF serves as an alternative to the STL file format, which has been in use to transfer 3D model data to AM systems since 1987. AMF is based on XML (an open standard markup language) and supports units, color, textures, curved triangles, lattice structures, and functionally-graded materials—features that the STL format does not support. An AMF file is about half the size of a compressed STL file.
additive processes	Same as additive manufacturing.
additive systems*	Machines used for additive manufacturing.
additive techniques	Methods used for additive manufacturing.
AM	Additive Manufacturing.
AMF	Additive Manufacturing File format.
binder jetting*	An additive-manufacturing process in which a liquid bonding agent is selectively deposited to join powder materials.
CAD*	Computer-Aided Design; the use of computers for the design of real or virtual objects.
CAE	Computer-Aided Engineering; CAE software offers capabilities for engineering analysis, such as determining a part's strength or its capacity to transfer heat.
CAM*	Computer-Aided Manufacturing; typically refers to systems that use surface data to drive CNC machines, such as digitally driven mills and lathes, to produce parts, molds, and dies.

CNC	Computer Numerical Control; machines equipped with CNC capabilities include mills, lathes, and flame cutters.
CT	Computed Tomography; CT scanning is a method of capturing the internal and external structure of an object. A CT scan results in a series of two-dimensional gray-scale images.
directed energy deposition*	An additive-manufacturing process in which focused thermal energy is used to fuse materials by melting as they are being deposited. “Focused thermal energy" means that an energy source (e.g., laser, electron beam, or plasma arc) is focused to melt the materials being deposited.
facet*	Typically a three- or four-sided polygon that represents an element of a 3D polygonal mesh surface or model. Triangular facets are used in STL files.
FFF	Freeform Fabrication; another name for additive manufacturing.
material extrusion*	An additive-manufacturing process in which material is selectively dispensed through a nozzle or orifice.
material jetting*	An additive-manufacturing process in which droplets of build material are selectively deposited. Example materials include photopolymer and wax.
metrology	The science of measurement.
MRI	Magnetic Resonance Imaging; alternative to CT scanning that offers better soft-tissue contrast; MRI does not use ionizing radiation.
NURBS	Non-Uniform Rational B-Splines; NURBS surfaces are used to describe the shape of 3D computer models that are mathematically accurate.
PIM	Plastic Injection Molding; popular method of molding parts from thermoplastic materials such as polypropylene, polyamide (nylon), polycarbonate, ABS, polyethylene, and polystyrene.
powder bed fusion*	An additive-manufacturing process in which thermal energy selectively fuses regions of a powder bed.
prototype tooling*	Molds, dies, and other devices used to produce prototypes; sometimes referred to as bridge tooling or soft tooling.

reverse engineering*	A method of creating a digital representation from a physical object to define its shape, dimensions, and internal and external features.
rapid prototyping*	Additive manufacturing of a design, often iterative, for form, fit, or functional testing, or a combination thereof.
rapid tooling*	The use of additive manufacturing to make tools or tooling quickly, either directly, by making parts that serve as the actual tools or tooling components, such as mold inserts, or indirectly, by producing patterns that are, in turn, used in a secondary process to produce the actual tools.
SFF	Solid Freeform Fabrication; another name for additive manufacturing.
sheet lamination*	An additive-manufacturing process in which sheets of material are bonded to form an object.
solid model	3D CAD representation defined using solid modeling techniques with a computer. Solid modeling is somewhat like using material such as wood or foam to create a shape. Many solid-modeling software products use geometric primitives, such as cylinders and spheres, and features such as holes and slots, to construct shapes. Solid models are preferred over surface models for additive manufacturing because they define a closed, "water tight" volume—a requirement for most additive-manufacturing systems.
surface model*	Mathematical or digital representation of an object as a set of planar or curved surfaces, or both, that may or may not represent a closed volume. Surface models may consist of Bezier B-spline or NURBS surfaces. A surface model may also consist of a mesh of polygons, such as triangles, although this approach approximates the exact shape of the model.
3D printing*	Fabrication of objects through the deposition of a material using a print head, nozzle, or other printer technology. Term often used synonymously with additive manufacturing; in particular associated with machines that are low end in price and/or overall capability.
3D digitizing	Same as 3D scanning.
3D scanning	Metrological method of determining the size and shape of an object using some amount of automation; often involves an optical device, such as a laser, and sensors that calculate the *xyz* coordinates using a technique called triangulation.

tool, tooling*	Mold, die, or other device used in various manufacturing processes such as plastic injection molding, thermoforming, blow molding, vacuum casting, die casting, sheet metal stamping, hydroforming, forging, composite layup tooling, machining, and assembly fixtures.
triangulation	A method of inferring the location of a point on a surface by projecting light onto the surface and observing that light, if possible, from a different angle or direction.
STL*	A file format for 3D model data used by machines to build physical parts; STL is the de facto standard interface for additive-manufacturing systems. STL originated from the term stereolithography. The STL format uses triangular facets to approximate the shape of an object, listing the vertices, ordered by the right-hand rule, and unit normals of the triangles, and excludes CAD model attributes.
vat photopolymerization*	An additive-manufacturing process in which liquid photopolymer in a vat is selectively cured by light-activated polymerization.

* denotes ASTM standard definition