DESIGN TERMINOLOGY

A Glossary of Commonly Used Terms

This glossary does not necessarily use dictionary definitions, but instead describes how *SPARK* uses these terms in our proposals and reports. The intent is to help you better understand our process and deliverables so we have clear communication and expectations while working together.

Engineering & Design Terms

2D Documentation
The detailed drawings which accompany 3D CAD files sent to manufacturers to document part material, color, and finish, quality control requirements, etc.

3D Data
These are the primary design files SPARK creates in CAD programs such as Solidworks and Onshape. These files are an exact, digital representation of the geometry of the parts and they are used by both prototype and production vendors to build physical parts.

Analysis
Detailed engineering analysis used to validate a design. Most commonly referring to Finite Element Analysis (FEA), but can also include other forms of computer simulation and/or scientific testing.

Bill of Materials (BOM)
The list of individual parts/components which comprise a product, including production information such as part number, part name, material, description, part quantity, etc.

Brainstorm
A working session involving two or more individuals collaborating to solve a design challenge with your product. Topics can range from broad conceptual ideas to very detailed, engineered solutions.

Computer Aided Design (CAD)
CAD refers to the various computer modeling programs used in this industry. The software is used by engineers and industrial designers to visualize designs and create the precise 3D data and 2D documentation required for prototyping and production. SPARK primarily works with Solidworks and Onshape, and occasionally Pro/E.

Conceptualization / Concept Generation
The process of early development, where various features or product attributes are imagined and combined to create numerous, rough, versions of a product for further comparison, development, and/or review.

Control Prints
Synonymous with 2D Documentation- these are the documents that accompany 3D data for molded plastic parts. Color, material, finish, and quality control dimensions are the most commonly included information.

Design Criteria
A document which captures the agreed upon objective and subjective success criteria for a product and their relative importance to the client or end user (ie. “Need to have” vs. “Nice to have”). Depending upon the complexity of the product, this can be very short or quite exhaustive.

Design for Manufacturing & Assembly (DFMA)
The process of designing a product with production in mind. This involves a deep knowledge of manufacturing processes and materials to assure parts can be built and assembled efficiently, cost effectively, and with the desired level of quality.

Engineering & Design Terms

Draft / Draft Angle
Draft is the angle, or taper, designed into a molded or cast part perpendicular its parting line. Draft is critical to parts being prepared for manufacturing, as a slight taper is necessary so the two halves of a mold can be separated and the formed part can be removed without binding or damaging the part. The amount of draft required varies depending on the material, process, part size, surface texture, etc.

eDrawings
A free program developed by Solidworks to allow individuals to view and rotate CAD data in three dimensions without purchasing the actual CAD design software. These files cannot be edited, but SPARK will often share them with clients to communicate designs.

Engineering
The creative application of science and mathematics to develop the parts, machines, or systems which form the foundation of usable products. SPARK often refers to this as mechanical design, but it can include everything from scientific experimentation, to "figuring out how to make it work," to preparing a part for manufacturing.

Exploded Parts View
An image which shows all of the parts that comprise a product "pulled apart" so an assembly can be visualized and/or all of its components can be identified. Most commonly used in conjunction with Bills of Materials to label parts.

Finite Element Analysis (FEA)
FEA is software which uses the "finite element method" to analyze a material or object and find how applied stresses will affect the part or design. FEA can help determine any points of structural weakness in a design before it is manufactured.

Ideation
The creative process of generating, developing, and communicating new ideas. Similar to brainstorming, but generally more focused, ideation can cover exploration of a product's functionality, aesthetic styling options, etc.

Industrial Design
The professional service of creating and developing concepts and features that optimize the function, ergonomics, value, and appearance of products and systems for the mutual benefit of both user and manufacturer. Please refer to our additional resources document on Industrial Design for a more thorough explanation and examples of industrial design work.

Kickoff
The initial (usually face-to-face) meeting between you and SPARK at the beginning of a new project or phase of development. These meetings are an opportunity for existing research, development work, or ideas to be shared so expectations and intent can be mutually communicated and understood.

Minimum Viable Product (MVP)
A minimal cost product with just enough features to satisfy early customers and provide feedback for future product development. For inventors and start-ups, this usually refers to a functional prototype.

Engineering & Design Terms

Nominal Wall
Nominal Wall is a measured dimension referring to the thickness of the walls of a molded plastic part. When designing plastic parts, a uniform thickness should be maintained throughout the part to avoid cosmetic flaws or weak spots caused by variations in cooling times and shrink rates after molding.

Parting Line (Partline)
The line where two parts of a mold or tool separate. This often creates a lightly visible line on molded plastic parts, but more importantly determines where the part's draft angle needs to switch directions so the tool can separate. Parting lines can be controlled to define curvature changes, splits between parts, and texture or material changes.

Production Design
A product that has been designed to a level sufficient to be directly handed off for manufacturing. This means all considerations for the required manufacturing process have been made and any necessary 2D documentation/3D data has been generated.

Production Ready
A product design that is fully documented and prepared for initial manufacture.

Proof of Concept (POC)
A validation prototype or test conducted to determine the viability of a design concept prior to further development. These prototypes are often crude, as they are meant to vet ideas with minimal expenditure, so many times they are only used internally at SPARK.

Prototype
An early sample, physical model, or small production run of a product that is built to test a concept or process and gather feedback for further development and refinement. Please see our additional resources document on prototyping processes for more information.

Rendering
A digital image created to visualize a product or concept. Usually these are higher quality images which show color, materials, and detail and can range from presentation quality sketches to computer generated images created from 3D CAD files.

Sourcing
The process of finding suppliers of goods or services. This can range from finding a specific spring, magnet, motor, etc. to be incorporated in a product, to locating a vendor for prototypes, production, or various professional services.

Tool-Ready
SPARK uses this term to describe molded plastic parts where the 3D design data has been fully detailed and prepared for manufacturing. This requires a high level of detailed CAD design work and knowledge of manufacturing processes.

Vendors
Any business entity responsible for producing or providing a product or service required as part of developing or manufacturing a product.

Volume

The level of production output from a manufacturer. There are often price breaks to allow a lower cost per part when production is in higher volumes. This ratio or trade-off is often used to calculate payoff periods to amortize capital investment.

Working Model

A prototype which is functional, but not necessarily aesthetically representative of a design. This version is reliable in functional performance and can be distributed to individuals outside of SPARK for market feedback or internal company review, but it may not look or feel like the final product.

3D Printing

DIRECT METAL LASER SINTERING (DMLS)
This 3D printing process utilizes a laser to fuse tiny solid particles of material together in thin layers, building layer on top of layer to eventually form a part. The resulting parts are typically very expensive, but they are very durable and can be post processed (machined, tapped, cleaned, etc.) for use in real world applications. This process produces higher resolution parts than SLS and FDM, but not SLA.

FUSED DEPOSITION MODELING (FDM)
This is the printing process used by most hobbyist and lower-cost 3D printers. It functions similar to a hot glue gun, melting plastic and depositing it through a small nozzle, known as the print head. The print head is moved by a computer, laying down successive layers of material until a part is formed. FDM parts are generally less expensive than ones made with alternative printing processes, and they can be durable in some situations, but they are less cosmetic and fine details cannot be formed.

SELECTIVE LASER SINTERING (SLS)
Largely identical to the DMLS process, SLS uses a laser to fuse tiny solid particles of material together. SLS parts are generally inexpensive and more durable than FDM parts, but they are not particularly high resolution. The benefit of SLS is that it offers the ability to print in a variety of materials to more closely represent real production parts, such as metals, nylon, ceramics, etc.

STEREOLYTHOGRAPHY (SLA)
SLA machines use a laser to cure light-sensitive liquid resins, layer by layer, to create parts. They are extremely precise, making this process ideal for testing fit, finish, surface quality, and feel. The limitations with SLA are that parts tend to be more brittle than molded plastic parts and they do not react well to temperature and UV exposure. SLA parts are excellent for testing assemblies prior to manufacturing, but they are not suited for production due to their limited shelf life.

Additive Manufacturing
A term commonly used to describe 3D printing, it refers to the process of depositing material in successive layers to eventually create a whole part or profile. The part is created by building up material rather than cutting away from a larger block.

Cast Urethanes
This is a process best suited for creating multiple, high-detail copies of a prototype or low-volume production parts. The resulting parts are durable, accurate, and can replicate production grade surface finishes, so they are ideal for gauging market interest prior to committing to more costly production tooling.

To create a cast urethane part, a two (or more) part mold is made from silicone formed around a 3D printed copy of your part. A urethane (plastic) blend is then poured into the mold and cured to form the parts. Typically these molds will last for around 20 parts before needing to be rebuilt. While this process can be expensive, it is more cost effective than 3D printing numerous copies of a part.

Casting
The process of pouring a molten or uncured material into a mold to form parts. When the poured material has solidified, the mold is opened and the part is removed. The mold can be reused to create multiple identical parts.

Injection Molding
One of today's most common manufacturing methods for plastic parts, injection molding consists of rapidly "injecting" molten plastic at high pressures into molds that are machined from solid aluminum or steel. These molds, called "tooling" or "tools," are capable of making thousands to hundreds of thousands of parts and can be extremely complex and expensive; however, the individual parts they create are highly accurate, very inexpensive, and fast to produce. Due to the high tooling cost, injection molding is best suited for high volume production where the tool cost can be distributed over a large quantity of parts.

Machining
Machining refers to a variety of processes that involve using a tool or machine to cut away material from a solid block, bar, or sheet of raw material to create a part. There are different machines, bits, and cutters (mills, lathes, etc.) for different features and finishes, and materials can have a wide range of possibilities. Machining is a common method for prototyping.

Sheet Metal Fabrication
Cutting, bending, and otherwise forming raw sheets of metal into practical parts with real world applications. Parts can also be welded, brazed, or mechanically joined to form more complex assemblies. Sheet metal fabrication is very common, and is less costly than machining, though the resulting shapes that can be made are more limiting. Sheet metal parts can still be finished to a cosmetic level with different degrees of coatings available.

Subtractive Manufacturing
The process of removing material from a stock sample of material to create a finished part. This is commonly used to describe conventional manufacturing processes such as machining or sheet metal fabrication.

SPARK

product development